P/REFERENCES OF DESIGN

DESIGN IN SEASIDE CONTEXTS: PRACTICES, MODELS AND EXPERIENCES OF WELLBEING, SOCIALITY AND SUSTAINABILITY.

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ABSTRACT | This paper proposes the synthesis of an academic research which, starting from 2016, examines projects, products, services and researches considering seaside environments as strategic places to examine in an innovative way how models of social well-being converge and change in relation of tacit, declared and emerging needs. The contribution intends to describe the role of design which, as a project science that integrates skills capable of generating and supporting development actions, offers concrete and unprecedented models of relationships, health, well-being, care of the body and the person when referred to the specific place. These actions are in some way to transform themselves into enabling and multiplying factors of social, community and intercultural connections. On the beach, therefore, the complexity of contemporary living is fully reflected: from the evolution of customs and habits to technological innovation; from economic to social changes; from ideological to cultural transitions. In addition to this, the beach context is notoriously characterized by the combination of natural elements, artefacts and rituals bound to the limits imposed by landscape protections in relation to the benefits of local communities, the beneficiaries of the sea coasts and the economic chains operating in the tourist-seaside sector. And it is precisely in this complex framework that those “devices” endowed with principles of coexistence between territory and people take shape, also in an attempt to balance the degree of anthropization of nature with bathing solutions which are able to consider new priorities and sensitivities. The beach environment also represents the close relationship between typology-service-user and how these changes over time. In this direction, the beach becomes a metaphor for the inhabited space in which man regularly brings together needs and interests. This is why, beyond leisure, well-being, relaxation, contact with nature, the beach reconstructs a multifaceted seasonally inhabited microcosm which draws from the city the idea of an expanded square in which public-private needs converge which welcomes and places for interpersonal, and in which relationships are tested in a dimension of sustainable opening. Among the design topics for the beach, it is possible to cite the continuous search for “models of harmony” between exposure of the body, social acceptance and natural elements; ecosystems sustainability; the appropriate use of inaccessible areas or “submerged beach” strips; spatial and urban regeneration; the relationship of the seaside system with territorial specificities, communities and local heritages; the entry of increasingly digital technologies; the updating and implementation of models of sharing and sociality between natural needs and personal needs; inclusiveness, interculturality and demographic changes; personal well-being and care also as access to the democracy of services; the new global health challenges. The selection of examples that will be described on an international scale will therefore have the task of representing how the beach habitat is a significant place to show the possible coexistence between anthropic activities and ecological emergencies such as to provide a map of good practices exemplifying a progressive culture which has as its objective a concrete regeneration of the seaside environment.

1. Introduction: From Healthcare to Wellness

From a methodological point of view, this contribution proposes a speculative reading carried out through case studies selected as models of good practices and as such representative of some areas of the product-service relationship in which values and solutions can be identified that belong to a kind of "new bathing culture."

These are selected examples of which strengths or weaknesses were not voluntarily analyzed in a strict sense but assumed to outline a kind of phenomenology of merit to which to give the task of outlining an overall frame of reference to represent the complexity of design phenomena that are traced on the beach environment between well-being, sociality and sustainability. Therefore, it was – not of the historical examples – primarily to form a kind of "empirical-speculative mapping" for a subsequent "mapping of practices," that is, to offer "gateways" capable of leading us among some of the most emergent traces of the "Spiaggiaverde" research.

The beach, in the classical tradition, is considered a mystical place, a line of contact between the land and the mysteries of the sea, a boundary between the solid and liquid worlds, and moreover a territory of the 'advent of life', but, moreover, an unpleasant, anxiogenic and dangerous area. The forerunners of this change of perspective are some French poets (e.g., Théophile de Viau, Tristan l'Hermite, Saint-Amant) who, from the beginning of the 17th century, "celebrate the ineffable joys of lurking on cliff tops, walking along the sandy shores and observing the changes in sea water" (Corbin, 1990). In this period, the beach gradually becomes a place of meditation and landscape contemplation; a natural environment - appealing to both Enlightenment and Romanticists - in a "subtle balance" between hermitic retreat and urban hubbub for which it is nevertheless preferable to be attended by "some particular person with whom to communicate in order to avoid the tedious solitude and oppressive multitude" (De la Hoguette, 1648).

Apart from a few exceptions, until the 18th century, the attraction to the properties of bathing did not yet possess the widespread character that we recognize today. However, the useful dimension of the beach comes to the fore and is concretely defined: its 'tranquility' as opposed to the pollution and noise of northern European cities, coupled with the promotion of medical therapies praising the beneficial effects of fresh bathing and salty air, makes coastal resorts 'desirable spaces' within a few decades. In fact, seawater began to be attributed curative properties in the same way as thermal water. In the mid-1700s, British coastal towns such as Scarborough, Brighton, Margate and Weymouth began to structure themselves to attract wealthy people who had the opportunity to indulge in seaside holidays to cure themselves of tuberculosis, asthma or simply regenerate from increasingly crowded and polluted urban environments. There was, in essence, a need to equip the beaches with support services for holidaymakers to make bathing comfortable, safe and, above all, compatible with the sense of decency and social rules of the time. In fact, undressing in public or showing oneself in a swimming costume was considered improper. It was also inappropriate to jump, run along the beach, or 'fool around in the waves' (Spurrier, 2008). Surprisingly, at least until the Victorian age, it was considered permissible to bathe naked, but always with health rather than a recreational or sporting purpose in mind, i.e. to dive briefly in the absence of the opposite sex and preferably in conditions of maximum isolation from potential prying eyes. In order to make this 'medical ritual' (Chase, 2005) adhere to the customary requirements of the Edwardian age, so-called bathing machines were developed: wooden and fabric huts mounted on mobile wagons (privately fitted out or rented) that were pulled into the sea like sedan chairs, often with the help of horses or by means of winches and mooring ropes.

Figure 1. A perspective view of Scarborough, John Setterington, 1735.

The first known representation of cabins on wheels appears in an engraving by John Setterington in 1735, but it was in 1750 that Benjamin Beale developed a model equipped with ladders, a small window and a fan-shaped awning (called a modesty hood) to safeguard the privacy of holidaymakers while bathing. This provided bathers with a means to cross the beach and a space to change and store their belongings (Darcy, 2020).

2. Not Only Leisure

Generally speaking, it is therefore possible to consider modern seaside tourism as an invention 'prototyped' and developed in British coastal cities and then, throughout the 1800s, extended across Europe to Normandy, south-western France, Italy, areas of Scandinavia and northern Germany. A tourist model capable, from time to time, of adapting to the different conditions of the context in which it is welcomed, implemented by the cult of health and sociality, as well as enriched with increasingly complete and complementary services declined in recreational, relaxation and entertainment components. The first architectural structures that were to be the forerunners of modern establishments were called 'kursaal' (treatment rooms), but, despite their name, they are very different spaces from simple places for treatment. Instead, they are large spaces offering, in a general way, both regenerating and socializing activities: social entertainment and various services including dance halls, restaurants, bathing and spa services, reading or relaxation rooms, games rooms, and theatres. Even in their earliest developments, they are primarily mundane and elitist places that involve strolling along walkways (pleasure pier) with the sea as a backdrop, while bathing in the sea is a self-defeating pleasure at first sight due to the 'brutal' immersion envisaged as a kind of shock therapy similar to a spa. Ultimately, "the beach has gone from being a source of food and a place where journeys begin and end, to a place of fun and recreation" (Weaver, Oppermann, 2000) and, over the years, from being a place for simple, practical relaxation to an area organized and spread out over twenty-four hours for an increasingly broader concept of personal 'care' and socialization (La Pietra).
The idea of 'leisure as compensation' (Löfgren, 2001)) developed in the industrial society of the 19th century. A 1903 guidebook for promoting tourism in the Catskill Mountains (USA) supports the following thesis: “We need change, we cannot live by monotony or systematic routine. Each of the five senses needs a new diet and a change of regime. This is not possible in the atmosphere or horizon of one's own city, even if one stops working or doing other activities completely. Everything has to be changed: the air, the environment, the room. The food. The people we meet, the sounds we hear; to detach ourselves from the rest and secure the desired benefits.” (Hendricks, 1903) The desire to possess the beach spread in the European continent from the first decades of the 19th century. Even if timidly: 'bathing still consists of a quick dive, you "catch

the wave", you breathe iodine, but you don't swim. The swimming costume is an invention of the 20th century and only after 1920 did one lie in the sun' (Boyer, 1997). Throughout the 20th century, and especially after the Second World War, innovations were experimented in bathing environments all over the world, capable of solving the various technical contextual criticalities and evolving needs, customs and models of both individual and collective well-being.

3. Individual Wellbeing

Due to the general aggressiveness of seaside environments (sunshine, exposure to winds, salt, strong thermal variations), solutions for individual protection are necessary, understood as a mediation between the pleasantness of exposure to natural and meteorological elements and the possible discomfort caused by them. A historical type of bathing furniture born precisely from the search for this balance is certainly the so-called 'strandkorb' (Potthast, 2024). Such seats, for private use, have been known since the 16th century in Hamburg (1595), Lübeck (1611), Bremen (1648) and Cologne (1773). The first real single-seater strandkorb (literally 'beach basket') did, however, make its appearance in 1882 and was made by Wilhelm Bartelmann, a basket-maker from Rostock, for Elfriede von Maltzahns, a lady suffering from rheumatism (and therefore particularly sensitive to the cold wind) who often went on holiday to Warnemünde. The strandkorb comes in two main variants: the first is in the shape of a chest with a straight cover and drawer footrest, used mainly on North Sea beaches; the second is in the shape of a basket with a rounded wicker cover, used mainly on Baltic Sea beaches. In both cases, the main feature of these bathing chairs is the high canopy back that provides cover and protection from wind, sun and rain. The use of the strandkorb began to spread after Bartelmann's wife, Elisabeth, opened a bathing establishment near the Warnemünde Lighthouse in 1894 where, for the first time, seating was offered for hire. Elisabeth, as well as understanding and publicising the use of these seats/cabins as a bathing service, encourages her husband to develop the project further. Bartelmann then designed the two-seater version with a canopy, footrests and side folding tables. Felix Schneider in 1893 patented a model that could be folded and transported as a kind of large picnic basket. Then, in 1897, Johann Falck, Bartelman's previous collaborator, improved the mechanical system for opening and adjusting the backrest, defining the model that is still in use today.

Figure 2. Strandhotel U. Kaiserhof, Rudolf Jahn, Borkum-Dresden, 1899, postcard.

In 1820, the British surgeon and paleontologist Sir Everard Home conducted the first scientific studies on the effects of sun exposure on skin burns. The first sunscreen with a chemical composition was formulated experimentally in 1891 by the German Friedrich Hammer. The association between skin cancer and prolonged exposure to sunlight was then discovered in 1894 by two separate studies. In Germany, Paul Unna observed degenerative changes on exposed areas of sailors' skin and, in France, William Dubreuilh, Professor of Dermatology at the University of Bordeaux, analyzed the incidence of actinic keratoses and skin cancers in vineyard workers (Ma, Yoo, 2021).

Despite these important discoveries, the invention and clearance of bathing within a few decades 'freed' bodies, making exposure socially accepted in much of the world. After the First World War, summer sunbathing began to be fashionable and, widely, synonymous with affluence, beauty, availability of leisure time and good health, and no longer a symbol of poverty and toil. Until then, in fact, it was mainly fishermen and farmers who had dark skin. In 1935, French chemist Eugène Schueller, founder of the brand L'Oreal, formulated the radiation-filtering lotion 'Ambre Solaire Huile'. In 1956, the German physicist Rudolf Schulz introduced the concept of the sun protection factor (SPF) (Svarc, 2015). Until then, the real effectiveness of sunscreens was only suggested or simply promised by the slogans and images of increasingly uninhibited advertising posters. In essence, however, the first preparations are not very stable, do not resist water and only protect against UVB radiation, the main nuisance of which is erythema.

Today, on the other hand, the common lotions provide protection against UVA rays and, consequently, are indispensable products for conscious and truly careful bathing to prevent skin melanomas. There are some interesting contemporary design projects that deal with sun protection in an alternative way to chemical cosmetics. For example, SUN+ (Rosso, 2018) is a research on shapes, artefacts, production processes and materials designed to protect in a 'physical' way from overexposure to the sun's rays. The Dutch designers Brecht Duijf and Lenneke Langenhuijsen, integrating the theme with a marked eco-environmental and systemic sensitivity, propose a study straddling product and fashion design that tackles the objective of testing possible alternatives to the use of sun creams that are potentially harmful to the skin and, moreover, require polluting production processes and distribution practices. Starting from historical research on traditional cosmetic solutions (such as, for example, the use of ash or natural dyes), Buro Belén subsequently directed its investigation towards different sunscreen solutions, including temporary shelters and, more generally, textiles. This led to the definition of a collection centred on the adoption of filters and fabrics of vegetable origin for the creation of wearable accessories and mobile tents capable of providing adequate sun protection. Unseen Sunglasses, for example, replace ordinary lenses with an ultra-light metal material that is filigree machined and colour-matched to different human phototypes. The particular micro-etching lets in a third of the sunlight; which is sufficient to guarantee adequate protection for the wearer's eyes, without inhibiting their vision. The Vitamin Hat, on the other hand, is a sisal fibre hat characterized by a flap so wide that it is able to shade the wearer's entire body, but without hindering the physiological production of vitamin D. Sun Veils are natural garments that wrap around the body, defining, by layering, different degrees of solar filtering. Prosol D is a beach umbrella with an asymmetrical cover made of a specific biopolymer fabric developed in cooperation with the Institute of Textile Chemistry and Textile Physics at the University of Innsbruck. Finally, the Shadecloth range includes different types of 'textile barriers', designed and treated to provide varying conditions of protection according to the different phases of an outdoor day. These solutions, therefore, experiment with the physicality of sun protection by offering solutions that are at the same time natural, sustainable and healthy.

Figure 3. Sun+, Buro Belén (Brecht Duijf and Lenneke Langenhuijsen), 2016.

One project, on the other hand, that introduces smart technologies for sun protection is the My skin track micro-device designed by Yves Bèhar (Fuseproject) to constantly monitor sun exposure and to promote a model of tanning aesthetics that is not detached from correct dermatological prevention practices. The small sensor, developed by L'Oréal's Technology Incubator in collaboration with La Roche-Posay and presented in 2018 at the Consumer Electronics Show in Las Vegas, measures and records the user's exposure to UVA and UVB rays, environmental pollution, pollen and humidity (McNeill, 2019). The device also provides immediate updates on a person's general health status, storing the collected data for up to three months. The battery-free sensor is activated by sunlight using the NFC (Near Field Communication) technology of the user's smartphone. The aim is to provide bathers with an easy-to-use, discreet and effective accessory for collecting and organizing useful information to increase awareness of their skin's well-being and thus be able to take preventive action against melanomas or other skin diseases. The device is resistant to water and overheating, can be stuck directly onto a fingernail and is equipped with a metal clip that allows it to be clipped onto a bathing suit. In an updated version, the technology of this small digital 'button' is being incorporated into an adhesive patch that can be applied directly to the skin.

4. Social Wellbeing

The second group of case studies collects initiatives capable of acting on the scale of the beach-space with actions capable of imagining for the context shared and, therefore, socializing times, themes and fruitions. The beach thus becomes an 'open square', a place of dialogue between residents and holidaymakers, an ideal and multifunctional space for 'being well together' and for hosting the functions of welcome, dialogue, culture and collaboration.

With the Bibliobeach project, for instance, Matali Crasset creates a pop-up library that transfers free book lending services to a seaside context in a temporary and light format. The structure exploits materials and construction systems typical of outdoor furniture: aluminium profiles, and colored canvas and mechanisms for simple folding. The result is a sort of "cultural isle" consisting of a central location for the operator, delivery desks and three rest areas where one can "immerse" oneself in reading while lying on large mats

and protected by appropriate shade curtains. The Bibliobeach thus decontextualizes and makes the use of common library services more friendly and informal, offering itself as a "satellite" opportunity to share the pleasure of reading.

Another peculiar case study is the Sci-Fi Hot Tub by Zoe Walker and Neil Bromwich (2006). This is an inflatable platform for experimenting with a model of an immersive and contemplative bathing experience in high nature-value lake settings. The inflatable island, shaped like an iceberg, is equipped with a heated pool that accommodates participants in a warm and comfortable condition as they float and 'sail' through sublime, but also potentially hostile environments. The contrast between this shared 'comfort zone' and the vast expanse of nature encourages, in the designers' intentions, confrontation and collaboration between users in an isolated, non-hierarchical context. This defines a playful-conceptual experience capable of fostering dialogue between people and a general state of physical and emotional well-being for users. The artists worked with researchers from the Phase One Drugs Trials Unit at Hammersmith Medicines Research. The medical team led by Dr Mark Down defined a scientific methodology to assess the relationship between the art installations and the audience. The project thus explores the emotional impact of an art experience on the well-being of its users (Walker, Bromwich, 2009).

Figure 4. Sci-fi Hot tub, Zoe Walker & Neil Bromwich, 2006.

The Festival Internacional de Benicàssim, commonly abbreviated simply as FIB, is, since 1995, an annual art and music event that takes place in the city of Benicàssim, in the Comunidad Valenciana, Spain. The program includes mainly pop, rock and electronic artists, as well as short films, fashion shows and art installations for public enjoyment. The festival is held in July and includes performance areas, camping and bathing areas. The beach area, during the days of the event, must therefore be able to fulfil many functions, absorb an exceptional load of users, and provide diversified activities at different times of the day and night. In 2013, a group composed of several Spanish designers united under the name Collectivo Desenfreno, realized a temporary installation on the beach using, with a ready-made approach, transennas, metal fences, lighting bodies and shading fabrics. Specifically, the project stems from the

analysis of certain contrasts and criticalities that occur on the beach of Benicàssim during the days of the event. The designers identified two main types of targets: the holidaymakers, i.e. the ordinary beach vacationers, and the festivalgoers or Fibbers, the music festival tourists who live at night while relaxing on the beach during the day. In order to adhere to the needs and expectations of these two complementary targets, and to create opportunities for socializing between them, the installation has been arranged to be, during the day, a lounge area equipped with hammocks, deckchairs and tables for free use. At night, then, it transforms into a lighthouse; a luminous totem serving as a point of reference and aggregation.

The Weltevree Strandtuin bathing pavilion designed in 2015 by Floris Schoonderbeek explores new ways of recreational enjoyment that are not limited to the passive provision of goods and services, but which, in a general sense of eco-social awareness, invite holidaymakers to play an active role in the functioning of the bathing space (Välk, 2019). The temporary pavilion is designed to be energy self-sufficient and to utilize, in a self-sustainable manner, all that the beach has to offer: the wind barriers are made of dunes, wood collected nearby by the users themselves feeds small ovens for food and stoves for heating the water for the two relaxation pools, solar and wind energy provide the electricity needed for lighting and cooling systems, and a local well provides fresh water. Food and drink are kept cold in the Groundfridge cell, which utilizes the insulating effect of the sand. The Strandtuin, in the designer's intentions, does not put the visitor in "a cottage overlooking the sea", but requires a collaborative effort thus making him feel part of and creator of the place. It brings him into direct contact with the elements of the context, making him a proactive subject in commensurate with them with a non-predatory attitude, but in search of a possible balance between nature and the pleasantness of using the seaside resort. The holidaymaker thus becomes a bit of a bricoleur, a bit of a maker, a bit of a romantic castaway and has fun, collaborating concretely with his peers, to create sufficient conditions of comfort and anthropization.

Figure 5. Slingswing, WMB studio, Winter Stations, Toronto, 2015.

Another unique initiative is the international Winter Stations design competition which has been held annually since 2015 in Toronto, Ontario, Canada. Participants are tasked with designing temporary winter installations that incorporate existing lifeguard towers between Kew and Woodbine city beaches. The structures, disused in the cold period, are considered anchoring and distribution points for installations that have the aim of encouraging the use of the beach even in the cold periods by both local and occasional users and allowing them to experiment with new models of interaction with a normally unwelcoming context.

5. Interspecies Wellbeing

Today, the need for strategies oriented towards introducing models of dialogue and interspecies collaboration is strongly emerging. They are needed solutions useful to redefine the role of the human race in relation to other living species (plants and animals) and, on a broader scale of impact, to face global environmental emergencies. These have to be new models of "pacts" in which human activities connected to bathing or, more generally, to the use of beaches and marine environments, are not in conflict with ecological needs. Human interventions, indeed, can activate processes of environmental regeneration which, at the same time, recover and strengthen habitats and develop new non-predatory and, therefore, sustainable touristic economies. They are interventions, therefore, which do not preclude nature from human enjoyment with the aim of protecting it and which actually are characterized by a high intrinsic level of technical complexity that necessarily has to be managed in a holistic and interdisciplinary manner.
In reference to this eco-social sensitivity, for example, it is possible to mention "Underwater sculpture" (Gocova, 2013), the artistic research conducted since 2006 by Jason deCaires Taylor. In collaboration with some marine biologists, the sculptor, using a neutral pH cement, shaped groups of human figures to give life to submerged installations acting as passive dwellings for the proliferation of several marine species. This project puts art at the service of the sea. These sculptural groups serve as a warning about the ecological duties from which man cannot escape as the guardian of a unique and fragile heritage. The enjoyment of these mutable and hybrid works by tourists equipped with diving masks therefore becomes a metaphor for the relationship between nature and artifice in the suspended grandeur of the depths of the sea; but above all it experiments with new possible ways to conceive a sustainable coexistence between anthropic development, cultural growth and the creation of a model of tourism that is aware and respectful of the environment. Another experience that combines ecological and social practices is the Reef Cells project developed by Christopher Xavier O'hare (USA) since 2005. The research develops modules designed for the maximization of biodiversity in the marine environment through the production of an artificial coral reef characterized by cavities interconnected and internal surfaces that recreate ideal habitats for the taking root of marine species. Thanks to the use of a particular fiber-reinforced cement and a manual manufacturing technique, it is possible to obtain thin surfaces and light blocks in which the ratio between the overall volume and the interconnected internal space compared to the quantity of material used and the minimum area of the occupied seabed is optimized. The dimensions, the irregular and rough shapes and the spatial organization of the internal voids are designed to obtain diversified modules capable of camouflaging and integrating with the ocean floor. The construction of the modules involves the creation of layers of free-form concrete "veneers" around a base with a column which guarantees rigidity and facilitates transport and lifting operations of the final structure. The modules are made manually with a simplified construction technique and are therefore practicable by volunteers from environmental associations. The project, for this reason, is a virtuous example of involvement and balance between local communities, environmental needs, scientific research and systemic development of the economies connected to bathing.

Another unique research in introducing universal priorities to the design of submerged beach use is the Sea Bathing Facility by Carlos Mourão Pereira (2007). It is an inclusive seaside path composed of a system of basins, walkways, seats and landing places designed to accommodate a wide range of users (children, elderly, blind, people with limited mobility) in conditions of safety, comfort and dignity (Ebrahem, Alsaadani, El Sayad, Elseragy, 2018). The direct contact with nature is facilitated and encouraged since the structure protects bathers from wave motion and, at the same time, defines small habitats in which marine life can naturally develop. These biological tanks thus become invitations to discover plant and animal

species in a multisensory and integrated way. Everything is made of recycled concrete, a material that meets functional, economic and ecological needs, as well as requirements for resistance to sea water. Furthermore, the basin system does not require a mechanical water filtering system because, thanks to its position and shape, it exploits the tides as opportunities for water recirculation and purification and "biological exchange" between basins and the ocean. Furthermore, this specific location "on the water's surface" is designed to encourage a seaside experience that is as symbiotic as possible with nature. This “accessible border” space therefore takes on a rich and specific multisensorial character. It is an adaptive place where wind and water interact in a mediated form with the coast, and therefore where anyone can enjoy the pleasant tactile, olfactory, acoustic and material sensations of the marine elements.

Econcrete (Sella, Perkol-Finkel, Rella, 2018), then, is an interdisciplinary macro-research which, since 2012, has involved biologists, ecologists, environmental engineers, designers and specialists in concrete technology for the creation of particular blocks for the stabilization of the seabed and the construction of coastal barriers. The modules, characterized by tube-like surface depressions, are made with a specific mix of chemically balanced concrete which guarantees a level of microporosity that favors the growth of organisms such as algae, oysters, corals or barnacles. These organisms act as an ecosystem nursery and as a biological glue, improving the strength and durability of the structures and, therefore, increasing their stability and longevity. The result is an intervention model and a construction practice that does not damage marine habitats but understands them and acts with them, facilitating the best conditions for the development of healthy and diversified ecosystems that are also capable of contributing to the quality and effectiveness of the infrastructure. The ECOncrete mix is up to 10% stronger than traditional concrete, with a 70% lower carbon footprint when used in combination with slag cement and is designed not to release particles into the marine environment. In recent years, pilot barriers have been installed in different natural and climatic contexts (temperate, tropical and estuaries) and in urban port areas. In few months, in different ecosystems it has been observed that the units manage to develop a high range of native species within them. These "living infrastructures" have now been adopted globally in green architecture projects in Spain, Holland, the United States of America, Israel, England, Germany, France and Hong Kong.

Figure 6. Econcrete, Ido Sella and Shimrit Perkol-Finkel, 2012.

Another international research and innovation center for the marine environment is the Reef Design Lab (since 2013). The Australian multidisciplinary company is specialized in the design of infrastructures for the development or support of marine habitats for commercial or research applications. The company collaborates with different types of marine researchers, including coastal protection experts, eco-engineers

and biologists. The studio was founded by industrial designer Alex Goad who leads a team based in Menton. The research group's overall work focuses on combining experimental materials and digital fabrication technologies with traditional coastal management techniques to create economically and environmentally sustainable solutions that respond to current and future ecological emergencies. The MARS project (2013), for example, addresses the critical issues of coral reefs due, globally, to ocean warming and acidification, destructive fishing practices, and the presence of invasive species. The project, aimed to create a nursery for corals, develops a three-dimensional and modular structure that can be transported by small boats and installed by divers without the aid of heavy machinery (to which many communities do not have access). The system can also be built in reference to local specific needs or recovery objectives. The modules are manufactured through 3D printing using a particular inert ceramic compound. The Living Seawalls project (2018) was developed in partnership with biologists from the Sydney Institute of Marine Science to test the possibility of making ecologically productive artificial coastal walls such as dams and barriers in ports or urban areas (Bishop, Vozzo, Mayer-Pinto, Dafforn, 2022). Normally these vertical surfaces are flat, continuous and free of cracks or surface textures. These conditions make their colonization by native organisms difficult. On the contrary, the project proposes a system of hexagonal concrete panels morphologically designed to encourage the development of a varied plant and animal microecology. The Wave Break project (2022), on the other hand, is aimed at improving a possible balance between marine habitat and tourist activities. Large porous bells, located near the submerged beaches, provide coastal protection, reduce erosion phenomena caused by the force of the waves, enrich the natural habitat, thus constituting a hybrid and dynamic attraction for snorkeling activities during the high tide phases and for naturalistic observations during low tide phases. The first modules were made with a mixture of ecological concrete mixed with fragments of locally sourced marine shells.

Similarly, the X-REEF project (XtreeE - SEABOOST, 2017) applies 3D printing processes for the creation of large concrete products to be used as ecological nurseries and for the restoration of coral reefs. Designed in collaboration with biologists, the dimensions, the shapes and the textures of the cavities were, once again, have been defined to maximize the reproduction of the underwater species. A first prototype was immersed in the Calanques natural park in France. The technology adopted, specifically, made it possible to recreate the morphological complexity typical of the so-called "coralligen". Coralligen is a marine bioconstruction, that is, a permanent structure formed by the stratification of some plant species that grow by accumulating calcium carbonate on the cell wall. This type of growth significantly increases the volume, complexity and heterogeneity of the marine habitat, attracting a large number of other animals and plants. Consequently, the coralligenous is a very biologically rich environment, so much so that it is considered the second most important biodiversity hotspot in the Mediterranean, after the Posidonia meadows. In nature, this peculiar ecosystem can take several hundred years to form and then gives shelter to thousands of living species including fish, crustaceans, corals, algae, plants and mollusks.

Another example of effective and sustainable collaboration between human intervention and biological needs is the Tetrapots project by Sheng-Hung Lee - Wan Kee (2014). Artificial sea defense infrastructures are usually composed of stacked breakwater modules of various shapes. These are considered highly impactful from a landscape point of view and, under certain conditions, not sufficient to counteract the continuous action of wind and waves. Mangroves actually perform the function of protection and mitigation between water and land in nature, but due to the greenhouse effect and global warming, it is estimated that more than 35% of this valuable plant has already disappeared. The Tetrapot cavities are designed to host and develop mangroves, thus generating a symbiotic relationship between nature and artifice. The roots of the mangroves will, over time, strengthen the bond between the modules by holding them in place and thus creating a more effective chain of shoreline protection. they will come together to create a long-lasting sea defence of growing trees and roots that help hold the blocks in place. As the plants continue to grow backwards from Tetrapot, the roots intertwine and gradually form a natural defence from the sea. The product thus not only prevents soil erosion but also helps to protect and create a natural habitat (Salam, Prasad, Noor, 2023).

In 2018, due to the destructive force of Typhoon Mangkhut, the city of Hong Kong lost about 80 per cent of its coral reef. Designers from the Robotic Fabrication Lab, as part of the Fabrication and Material Technologies Lab in the Faculty of Architecture, and marine scientists from the Swire Institute of Marine Science (SWIMS) in the Faculty of Science at HKU jointly developed a new method for reef restoration, using 3D-printed artificial 'tiles' specially designed to promote the rooting and, thus, proliferation of corals (Lange, Ratoi, Co, 2020). In July 2020, the field trial started with the installation of an area of around 40 square metres of terracotta modules prototyped by digital manufacturing. The test was conducted at three selected sites within the Marine Park, including Coral Beach, Moon Island and a sheltered bay near the WWF Marine Life Centre. Specifically, the modules promote the restoration of corals and various forms of marine microhabitat in general by providing a structurally complex and porous mesh for coral attachment and preventing sedimentation, a major threat to corals. The recent 3D-printed artificial reef designs present are site-specific and a universal solution may be difficult to calibrate, as there are various types of underwater conditions. However, a common denominator, pioneered by the Japanese team, can be considered the use of natural materials, i.e. capable of not altering the underwater flora and fauna. To this end, the researchers deemed clay suitable as it is chemically similar to the calcium carbonate found in real coral reefs.

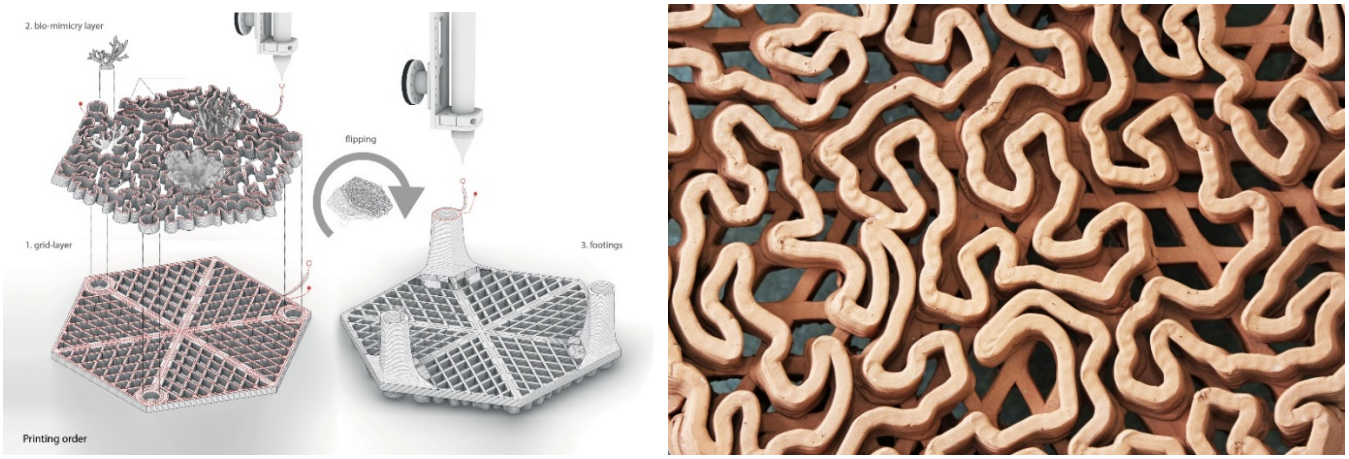

Figure 7. 3D Printed tiles, Robotic Fabrication Lab, University of Hong Kong Faculty of Architecture, University of Hong Kong Swire Institute of Marine Science, 2020.

6. Conclusions

The analysis of these specific case studies demonstrates how much the beach environment is a complex microcosm in which they are experimented with sustainability issues centred on principles of well-being and sociality. These models of sustainability are entirely centred on an equally complex thought of anthropogenic and environmental regeneration that in confronting design culture brings into focus how much design space there is to fulfil and sustain social, economic, and technological needs in addition to those imposed by climate changes. Therefore, by selecting different experiences, objectives and geographies, the examples illustrated to highlight the strong relationship that insists between "natural heritage", "bathing context" and "design role" in different possible product-service combinations. That is to say, whatever design action is developed in the beach-sea relationship, it demands intelligent practices in the mediation between nature and artifice. For this reason, the beach, as a territory, represents a privileged place from which to observe the responsibility of the project in proceeding according to different and possible models of development and of an answer to evolving needs. In other words, a context from which to examine the responsibility of the project and designers in introducing appropriate regenerative actions. In this direction, among the project themes that most interpret these objectives, design culture has to face new challenges for ecosystem sustainability, for the appropriate use of impervious areas or of the "submerged beach" strips, for a renewed relationship of the beach system with territorial specificities, for the adoption of digital technologies, for the updating and the implementation of models of sharing and sociability between natural and personal needs; demographic changes; and personal well-being and care.

All together, these important topics show how the beach as a composite habitat is a significant place to show the possible coexistence between human activities and ecological emergencies. In the end, all that has been said so far spills over in a methodological key into the possibility that for designers the beach environment can be an "objective context" from which to examine the responsibility of the project and therefore of the designers in introducing targeted redevelopment actions. A redevelopment that can - not without risk - test the reconciliation of different objectives also from playful activities capable of dialoguing with the social dimension and environmental sustainability. To be consequently open to experimentation, to the unexpected, to the reversibility of the result in the certainty that design is a "heteronomous" discipline because of the uninterrupted relationship and dependence it has with other knowledge (interdisciplinary vocation). This awareness enables design and designers to move beyond a "simple" problem solving model to a "consciousness of reality" that requires designers to constantly understand that it is never about making products or services but deploying effects in the world.

References

Bishop, M. J., Vozzo, M. L., Mayer-Pinto, M., & Dafforn, K. A. (2022). Complexity–biodiversity relationships on marine urban structures: Reintroducing habitat heterogeneity through eco-engineering. *Philosophical Transactions of the Royal Society B, 377*(1857). https://doi.org/10.1098/rstb.2021.0393

Boyer, M. (1997). *Il turismo. Dal Grand Tour ai viaggi organizzati*. Universale Electa / Gallimard, Storia e Civiltà.

Chase, L. (2005). Public beaches and private beach huts: A case study of interwar Clacton and Frinton, Essex. In J. K. Walton (Ed.), *Histories of tourism: Representation, identity and conflict* (pp. 211–227). Channel View Publications. https://doi.org/10.21832/9781845410339-014

Corbin, A. (1990). *L'invenzione del mare. L'occidente e il fascino della spiaggia*. Marsilio.

Darcy, J. (2020). Promiscuous throng: The 'indecent' manner of sea-bathing in the nineteenth century. *TLS. Times Literary Supplement*, (6118), 4–6.

De la Hoguette, P. F. (1648). *Testament* (Cap. XXXII, “De la conversation”). Vitré.

Ebrahem, S., Alsaadani, S., El Sayad, Z., & Elseragy, A. (2018). Exploring multi-sensory designed architectural spaces. *The International Journal of Architectonic, Spatial, and Environmental Design, 12*(4), 15. https://doi.org/10.18848/2325-1662/CGP/v12i04/15-24

Gocova, A. (2013). Artlantis: Jason deCaires Taylor's underwater sculptures protect coral reefs and usher in a new era of tourism. *Alternatives Journal, 39*(3), 34–38.

La Pietra, U. (1987). In C. Morpurgo (Ed.), *Cultura balneare*. Alinea Edizioni.

Lange, C. J., Ratoi, L., & Co, D. L. (2020). Reformative coral habitats: Rethinking artificial coral reef structures through a robotic clay printing method. In *RE: Anthropocene, design in the age of humans: Proceedings of the 25th International Conference on Computer-Aided Architectural Design Research in Asia, CAADRIA 2020, Volume 2* (pp. 164–171). Association for Computer-Aided Architectural Design Research in Asia (CAADRIA). https://doi.org/10.52842/conf.acadia.2020.2.164

Löfgren, O. (2001). *Storia delle vacanze*. Bruno Mondadori.

McNeill, S. J. (2019). Mobilizing skin care: Measuring and tracking external conditions with light emitting diodes. *European Journal of Social Science Education and Research, 6*(2), 17–21. https://doi.org/10.26417/ejser.v6i2.p17-21

Potthast, J. B. (2024). The Strandkorb, my Strandkorb is my castle: Intellectual property around the wooden beach fortress. Retrieved 8 March, 2024, from https://www.dpma.de/english/our_office/publications/background/strandkorb/index.html

Rosso, A. (2018). Sun protection according to Buro Belén. Retrieved 8 March, 2024, from https://www.domusweb.it/en/design/2018/08/13/sun-protection-according-to-buro-belen.html

Salam, A., Prasad, S., & Noor NV, N. (2023). Study on effectiveness of tetraPOT as coastal protection structure. *Study on Effectiveness of TetraPOT as Coastal Protection Structure* (April 14, 2023). https://doi.org/10.2139/ssrn.4559335

Sella, I., Perkol-Finkel, S., & Rella, A. (2018). ECOncrete technologies: Bio-enhanced concrete for coastal and marine infrastructure. In *Coasts, Marine Structures and Breakwaters 2017: Realising the potential* (pp. 549–552). ICE Publishing. https://doi.org/10.1680/cmsb.63174.0549

Spurrier, N. (2008). The lost technology of bathing. *Engineering & Technology, 3*(15), 94–95. https://doi.org/10.1049/et:20081519

Välk, S. (2019). The reflector: Design for enriched music festival experiences through meaningful interactions at Into The Great Wide Open. https://doi.org/10.31237/osf.io/fbshp

Walker, Z., & Bromwich, N. (2009). *Panacea casebook*.

Weaver, D., & Oppermann, M. (2000). *Tourism management*. John Wiley & Sons.

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