Figure 1. Facade element fabricated at IAAC using digital manufacturing optimized to grow Oyster Mudhroom

DESIGN FOR COMPANION SPECIES: DEVELOPING COLLABORATIVE MULTISPECIES URBAN ENVIRONMENTS

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The Urban Environment has been developed through centuries as a complex machine to host human beings and their activities, excluding external factors disturbing anthropogenic activities. Part of this process consisted in excluding the so-called "nature" (except a few selected species) from cities. However, a new consciousness about the effects of anthropogenic activities on our planet and about the regulating properties of nature on the environment is bringing us to reconsider the introduction of nature in cities, rethinking our cities as environments built to host multispecies co-existence and collaboration.

anthropocene / nature-based solutions / design / multispecies environments / bio-integration

Figure 2. World making project - Arachnocampa luminosa glowing structures in its environment to attract prey.

ANTHROPOCENE: GAIA 2.0

Through the development of civilization and human knowledge, philosophers have described Nature as a grand and universal realm with its dynamics and equilibria, but also determined by series of cyclical evolution and passive transitions. Nature was a backdrop and resource for the intentionality of Man, which could tame and master it. It has happened that many things undermined this vision. Considering all the anthropic processes, which have been exacerbated in the last century, has determined such a significant footprint that it is unclear whether life on Earth can continue (Tsing, 2015). This new awareness led geologists to coin a new term and began to call our time Anthropocene, the epoch in which human disturbance outranks other geological forces. (Crutzen, 2002; Sijmons, 2014)
According to the Gaia hypothesis by Lovelock and Margulis, living things are part of a self-regulating mechanism on a planetary scale that has preserved habitable conditions for the three and a half billion years ago. It is based on the premise that the oceans, seas, the atmosphere, the Earth's crust and all the other geophysical components of the planet remain in suitable conditions for the existence of life, thanks to the behavior and action of living organisms, plants and animals (Lovelock, 2009). Gaia worked without foresight or planning on the part of organisms,

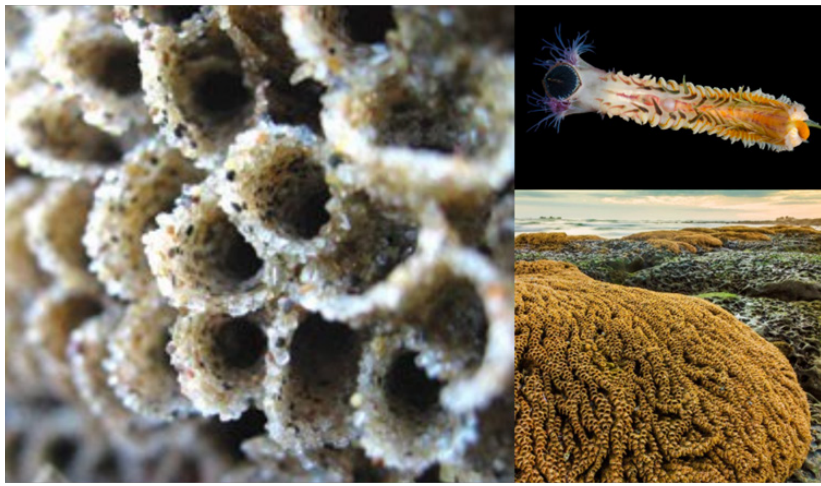

Figure 3. World making project - Phragmatopoma Californica lives in a tube structure and extends its tentacles out of the tube to catch food particles and sand grains

but the evolution of humans is changing this equilibrium. As said, this change has been described as the starting of a new epoch in which disturbance outranks other geological forces and people are beginning to gain awareness of the global implications of their actions. As a result, intentional self-regulation —from personal action to global geoengineering schemes— is either happening or imminently possible. Making such conscious choices to operate within Gaia constitutes a fundamental new state of Gaia, which Timothy Lenton and Bruno Latour call Gaia 2.0. According to their theories, by emphasizing the agency of life-forms and their ability to set goals, Gaia 2.0 may be an effective framework to foster global sustainability (Lenton & Latour, 2020). Consequently, to this new understanding of the planet, we are starting to think beyond inherited categories and capacities (Haraway, 2016) and to analyze and describe the Earth's dynamics according to a new sensibility. Anna Tsing (2015) describes the activities of life-forms as making words. She states that we are surrounded by many world-making projects, human and not human. These projects emerge from practical activities of making lives, in the process these projects alter our planet. Without the ability to make workable living arrangements, species would die out, at the same time, in the process of making, each organism alters everyone's world (fig.2,3). World-making projects can overlap, allowing room for more than one species, for example bacteria made our oxygen atmosphere, and

Figure 4. Facade element fabricated at IAAC using digital manufacturing optimized to grow Oyster Mudhroom

plants help maintain it, and plants live on land because fungi made soil by digesting rocks.

DESIGN FOR MULTISPECIES: ASSEMBLAGE, ENCOUNTERS AND COLLABORATION

The idea of altering everyone's world is crucial to understand how this alteration can determine assemblage, encounters and collaboration synergies. In order to explain the relationship between life forms, Tsing refers in particular to the concept of assemblage: varied species mutualism influence each other in several ways, some thwart (or eat) each other, others work together to make life possible, still others just happen to find themselves in the same place. However, assemblages don't just gather lifeways, they make them: encounters and contamination changes world-making projects, mutual worlds and new directions can emerge. Species identities the place to begin and ways of being our emergent effects of encounters, and this means that we change through collaborations within or across species. As a consequence, contamination makes diversity (Tsing, 2015). Cohousing, coworking, community allotments and ethical purchasing groups are just some of the examples on which people are staking the future of design disciplines, from product

Figure 5. Floor element fabricated at IAAC using digital manufacturing optimized to grow herbs

design to infrastructure design (Mancuso S. et al., 2018). However, co-existence and collaboration is mainly conceived and planned as a single spice environment. What if we start to create cities designed to host and allow multi-species co-existence and collaboration? The example of natural ecological systems reveals mutualistic attitudes whereby living beings can help to shape the ecosystems in which they live, making them stronger, longer-lived and more resilient (Mancuso S. et al., 2018). In order to strengthen our cities resilience, using the words of Donna Haraway (2016), we require each other in unexpected collaborations and combinations.

DESIGN CITIES FOR BIO-INTEGRATION AND BIO-RECEPTIVITY

Marcos Cruz (2019) refers to the idea of designing and creating scaffolds for inhibition not only for humans, but also for surrounding biota according to the principle of bio-integration, moving from thinking about tectonics, performativity and materiality in buildings, to the understanding of architecture as an integrated system of inert and biological matter. According to specific environmental conditions, external surfaces can be designed as bio-receptors and eventually become bio-colony. If we implement bio-receptivity on a very large scale, we could really shift our cities from being the biggest polluters to becoming active agents in reversing climate

change. In a city in which the buildings and the urban environment are scaffolds designed for hosting multispecies coexistence and collaboration, living organisms become, alongside human beings, bio-citizens (Pasquero, 2019), contributing to multi-levelled system of exchange and collective intelligence. At this purpose Donna J. Haraway (2016) speaks about the need of a multispecies justice. The development of cities designed for multispecies coexistence and collaboration requires architects to imagine new urban typologies, able to host different living organisms. It is a crucial transition, where the urban environment stops being just a container of programmes and functions (Pasquero, 2019) and becomes an inclusive space that fosters dynamic processes of exchange.

Most natural organisms require specific conditions to live (e.g. specific temperature, humidity, light exposure, etc.) and the process of creating or re-creating habitats requires high precision and accuracy. The ultimate technologies in the field of construction have the potential to help us to manage this complexity. Advanced ICT and AI software can contribute to simulate growing systems, while digital manufacturing gives us the possibility to build specific, complex and unique pieces (fig.1,5). These innovations open the possibility to reach a design sophistication that was not even possible to control before.
In conclusion, a new approach to city design, which objective is to foster co-existence and collaboration between species, let us imagine the city of the future, where new encounters enhance resilience and boost diversification and evolution.

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