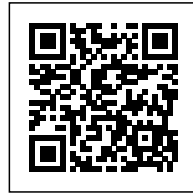




SHEIKH ZAYED PLAZA: THE URBAN ENVIRONMENT AS A LIVING URBANISM

Posted on December 24, 2020 by martabuges



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If we look at the urban environment as a living organism, with its circulatory systems, tissue stratification and matter metabolization, we start to understand why the generic urban patterns from the Modern period weren't completely effective, demonstrating why a better relationship between the natural and built environments needs to be at the center of the discussion for healthier cities. Although using biology to solve major problems in contemporary architecture is not novel, bionics offers numerous strategies based on the amalgamation of natural and artificial mechanisms, and in this case, bionics is used to enhance the circulation of people in the urban environment, with less impact and waste generation.

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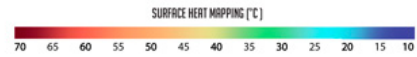
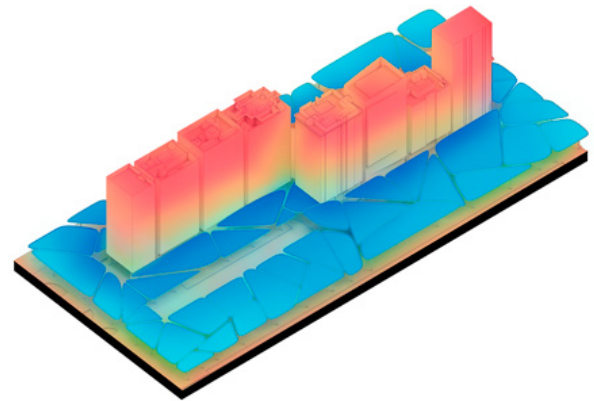
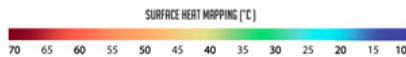
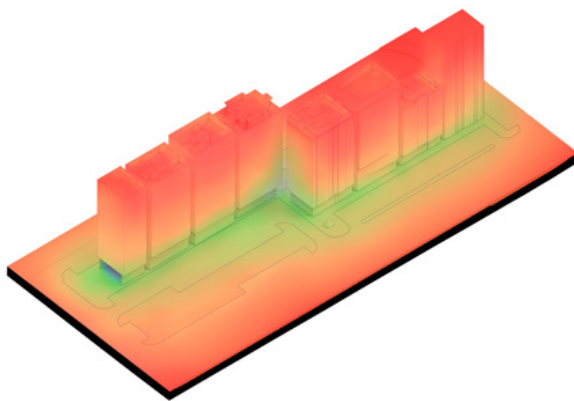


When used in conjunction with bioreactors, microalgae is up to 400 times more efficient than a tree at removing CO₂ from the atmosphere: 1 kg of algae requires about 1.8 kg of carbon dioxide, which is converted into biomass and oxygen. Now imagine if we could scale up this process and use algae at an urban scale. Not only would it sequester carbon dioxide and boost hyper-local oxygen levels; it would also dissipate the pollution haze that traps heat over the city, decreasing local temperatures.

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The Abu Dhabi Skins Experiment aims to take advantage of the outstanding cooling properties of water and photosynthesizing capacities of *Spirulina* genus algae to create a modular urban-scale cooling system, mitigating the urban heat island effect by attacking its key point generators: low-albedo surfaces, anthropogenic heat and air pollution.

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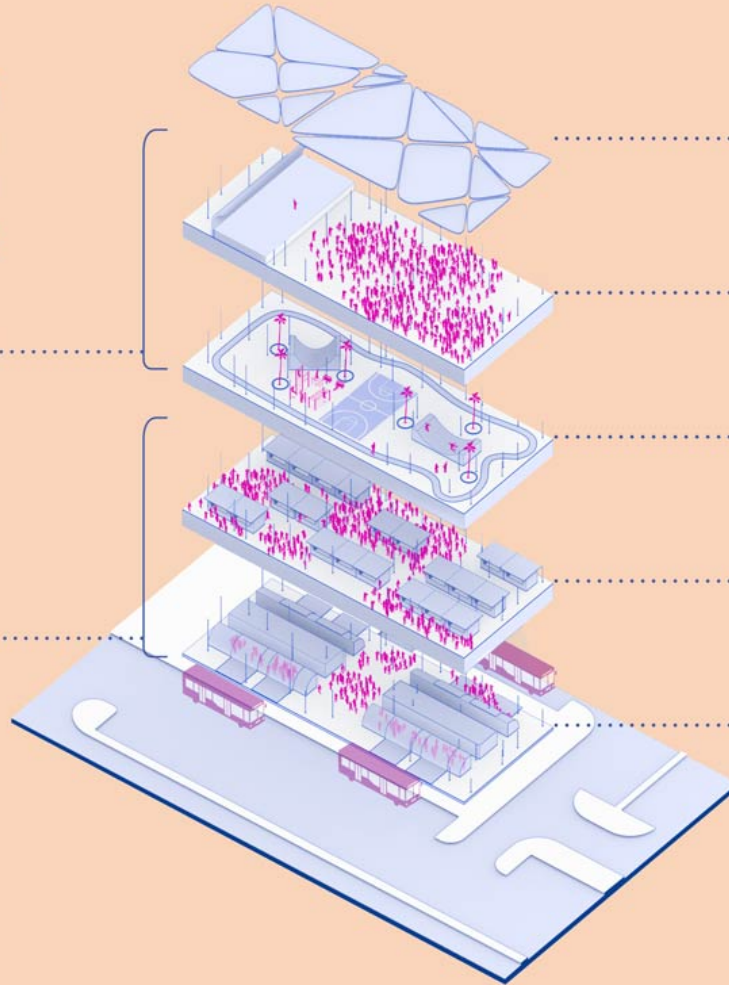
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MECHANIC VERSUS PASSIVE COOLING

The design central point was to be **HIGHLY FLEXIBLE** hosting different uses, making it easier for the DMT to implement the system in **MANY DIFFERENT SITUATIONS AND SPACE OCCUPATIONS**. The flexibility of the spaces also allowed the mechanic cooling to be used punctually, in specific situations, **AVOIDING THE MISUSE OF ELECTRICITY** and natural resources.

PASSIVELY COOLED SCENARIO (Composed by transitory spaces with users staying for a short time).

MECHANIC COOLED SCENARIO (Composed by non-transitory spaces with users staying for a long time)



URBAN ACTIVATOR AND USES FLEXIBILITY

1- URBAN ACTIVATOR - The equipment was designed to stimulate the locals to occupy the urban environment through different uses accordingly to specific necessities of the surroundings.

2- CULTURAL PLAZA - Exhibitions, shows and other kinds of urban occupation related to culture and art.

3- SPORTS PLAZA - multi-sport courts, skate ramps, running, children playground and other kinds of active lifestyle use.

4- COMMUNITY SOHO - modular shops create the perfect place to host community commercial activities and stimulating local entrepreneurship.

5- URBAN TRANSIT - In this specific case, it wouldn't be possible since the parking lot must be kept, but in other sites where the cars can be removed, the canopies can host urban transit hubs, with metro, bus and other modes in a single place.

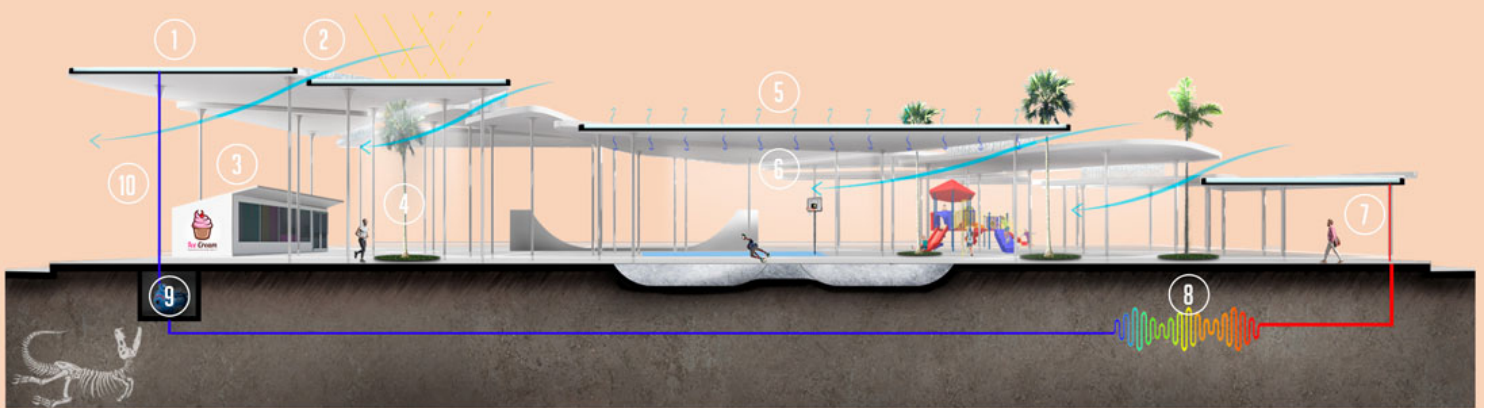
6- MIXED - Compositions to be explored are endless, mixing the already proposed uses or other ones such as campaign hospitals or emergency shelters for eventual housing problems.

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LESS OF URBAN FABRIC, MORE OF LIVING TISSUE

- 1- A thin layer of seawater acts in insulation and glare prevention. Water mirrors the low-e glass properties, actively filtering infrared radiation.
- 2- Structure gets lower in the direction of the predominant wind, forcing the airflow through the falling water, cooling the breeze through evaporative cooling in mildly humid days. The cool air gets heavier and goes down through convection, making the air at the user heights comfortable.
- 3- Flexible spaces allow the installation of retail, services and stalls, making it possible for the creation of closed spaces with mechanic cooling to be used in the summer months.
- 4- Great relationship with vegetation, promoting shadowed areas protecting irrigation system from water loss with thin evaporation and optimising water management.
- 5- Evaporative potential removes energy from the structure while the algae filters CO2 liberating Oxygen and improving air quality.



- 6- Radiant cooling helps the generation of a microclimate under the canopies, creating a cool layer at user heights.
- 7- Heated water is drained to the geothermal cooling system to be recycled.
- 8- Serpentine pipes use the stable temperature of the ground (Around 22°C the whole year) to dissipate heat from the water to the soil, making the sure the water in the plates are always cooler than the environment.
- 9- Solar-powered water pump, take the geothermally-cooled water back to the highest plate.
- 10- Pillars can be changed into different designs to showcase different cultural backgrounds.

Vegetation is the most obvious answer for cooling cities, but Abu Dhabi's harsh climate needs us to be more inventive than that since freshwater is not highly available, making large irrigated areas a bad option for urban resilience. The central strategy here was to replicate the effect of trees in other climates, without the disposal of a single drop of freshwater. The modular structural pattern creates a cluster of lightweight canopies, which might be applied to a large range of programs – from small public pavilions, plazas and walkable streets, to large compositions, covering entire neighborhoods – serving as a medicine for overheated areas, acting quickly acting to support local temperature regulation.

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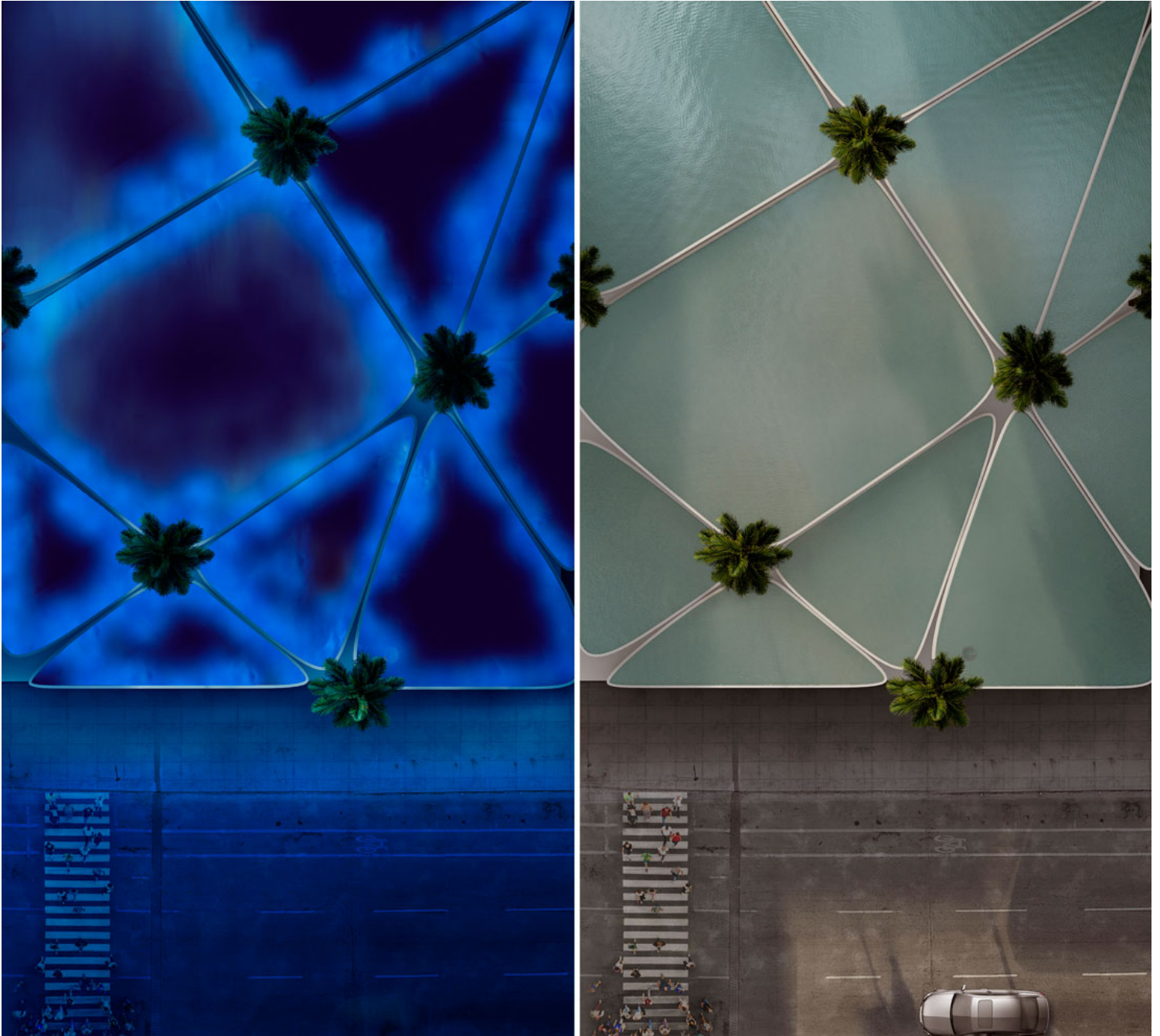
Taking advantage of the absorption and transmission properties of water, the water layer blocks infrared radiation, protecting the surface of the tanks from absorbing and re-radiating heat into the surroundings. The geothermally cooled water approaches a wet-bulb temperature of 15°C (a typical asphalt surface reaches 60-100°C), mitigating the albedo effect.

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The air temperature is approximately 50% radiant heat from surface radiation and 50% air temperature, which means that under large compositions of the system given air temperatures of

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35°C, a mean radiant temperature of structure and air of 25°C is achieved. With this 10°C drop in local temperatures, the number of days in which mechanical cooling is required can be cut by 15% to 20%, bringing down the carbon emissions embedded within electricity production, while offering better quality of life, more comfortable public spaces and a new source of wealth.

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