# WATERWALL

Low energy cooling elements
for urban public spaces

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Design & Social Context
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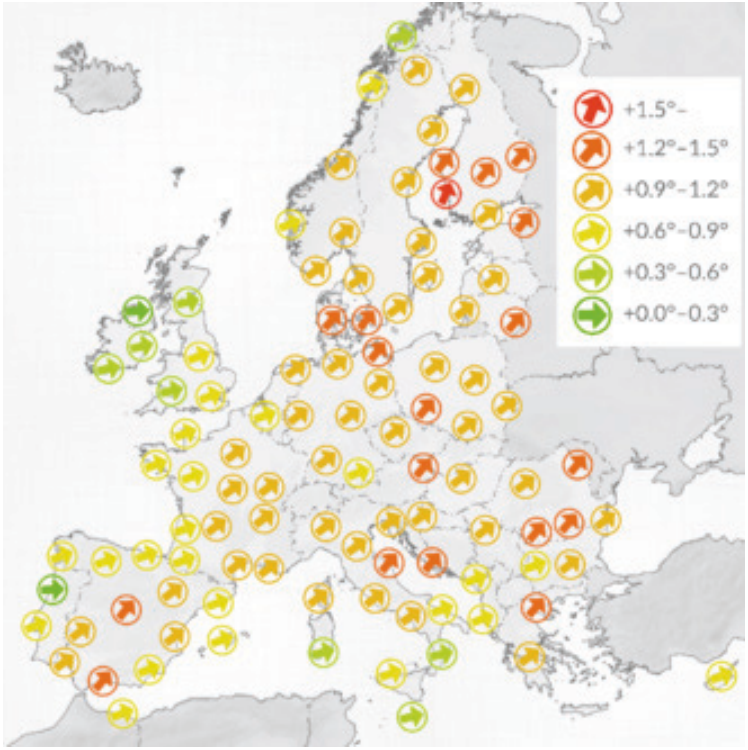
## FACT

As one of the effects of global warming, the world is heating up around us year by year.
According to various weather predictions, by the year 2050 the average temperature in Europe will rise in 1.8°c, and during the warmest month, it will likely increase by 6.1°c. Such a change will significantly effect the human's way of life in these areas. The European countries, which until now had to deal mainly with cold weather, should prepare for warm summers. During the last few years the heating effect began to be noticed, and questions arise about the correct solution.

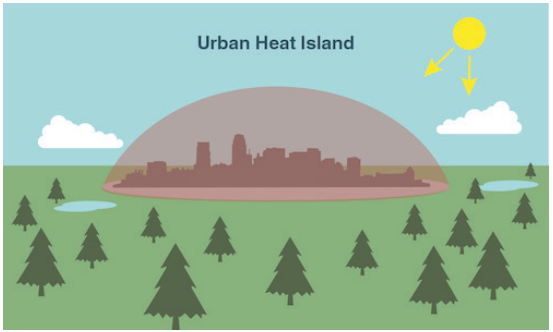


https://www.thelocal.de/20190712/climate-change-berlin-to-be-as-hot-as-australia-in-30-years

https:///assets.weforum.org/article/image/yHjznrW5ABlOk85CcvpSa39zKvV4C4-Q17qRTJiDw0Y

In urban spaces there is a heating effect called ‘Heat Islands’, making it warmer than the surrounding countryside. The ‘Heat Island’ effect is caused by the urban structure, which absorbs the suns heat more than natural landscapes, and the lack of air flow, since it is blocked by the many buildings and structures un the city.

Common heating systems in the cities, such as various air-conditioning devices, consume high amounts of energy, hence sending us on a search for new cooling systems and mechanisms, which will be sustainable, low energy and healthy, for humans and for nature.

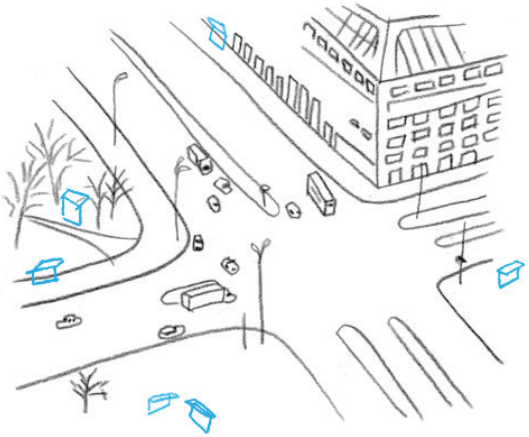


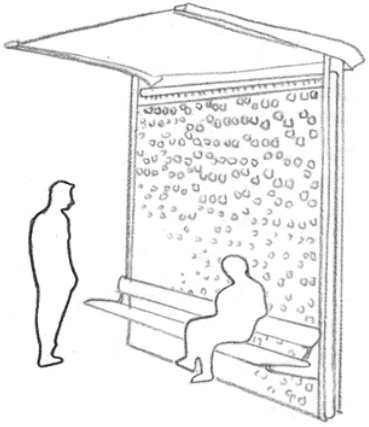

https://climatekids.nasa.gov/heat-islands/

## ACT

In this project I want to propose the WATERWALL, a new sustainably cooling element, suitable for different public urban spaces.
The WETWALL will preform as a cooling element in two levels:

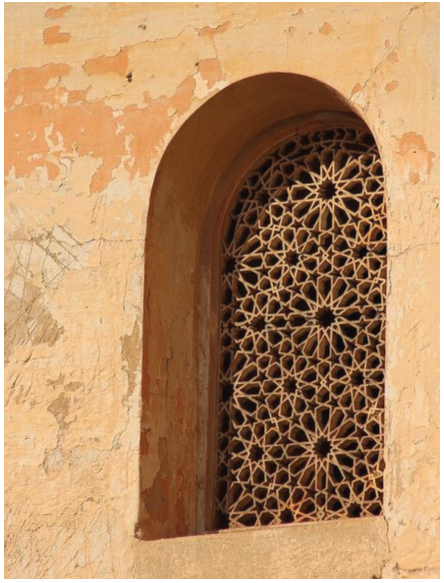
- As a small part of the general effort of making the city a cooler and more sustainable space.
- Creating cooled areas where the people could stop and relax for a while in the midst of the city.





The WATERWALL is a brick wall, made out of terracotta clay, designed so that once when it is wet it will cool the air around it. This technology of cooling can often be seen in warmer regions of the world, where the people have used them for many years as cooling systems.
The bricks are made out of terracotta clay, a porous material, which is good for absorbing liquids and holding them for longer times. During the manufacturing of the bricks, small grains called ‘Shamot’ will be combined with the clay, making it more fit for the changing weather throughout the year.

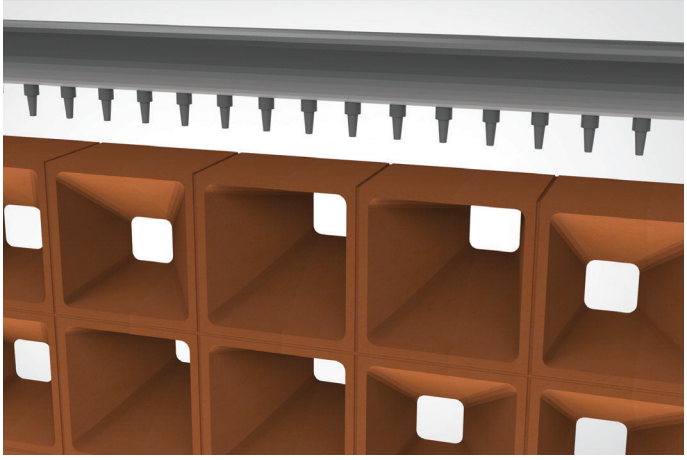

Photo by Monish Siripurapu/Ant Studio

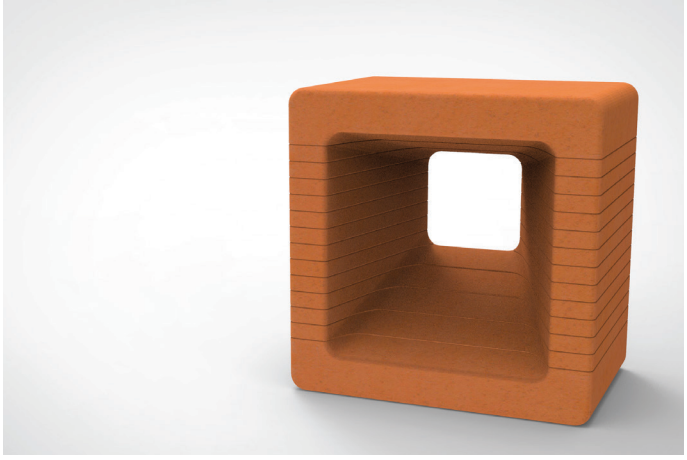

The 'Mashrabia', commonly used for shading and cooling.


Pearl Academy of Fashion Jaipur, India. 20°c less inside the building.
https///www.morphogenesis.org/our-works/pearl-academy-of-fashion/


Terracotta clay with 'Shamot'.

Each brick will be created by casting, and will be square shaped with a conic opening going through it, enabling the air to go through it easily. These openings, among other things, will increase the surface area of each brick, and thus also its cooling efficiency.
The water source is in the municipal water system spread under the city. The water is led by a plastic water pipe to the top of the wall, where it is released and poured down the wall, wetting the bricks. Each brick is lined with horizontal grooves that help the liquid to spread effectively and efficiently on its surface.
At the bottom of the wall are openings that collect the remaining water, later routed back to the top of the wall for reusing.

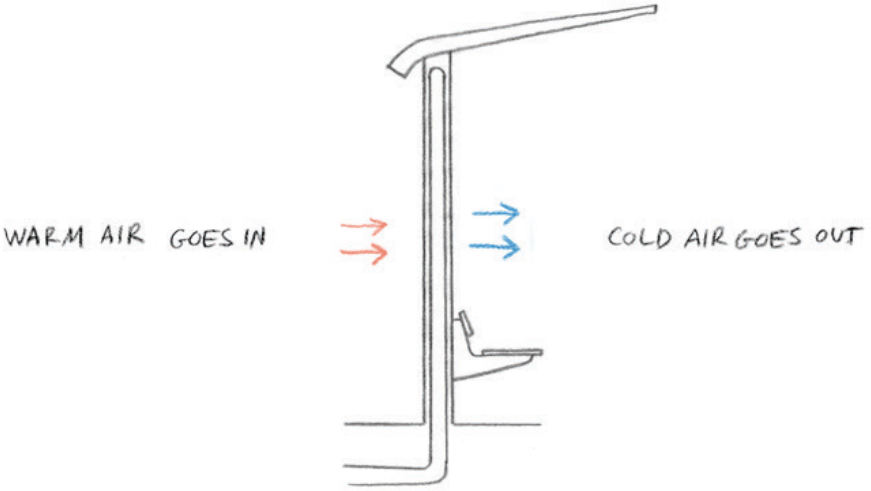


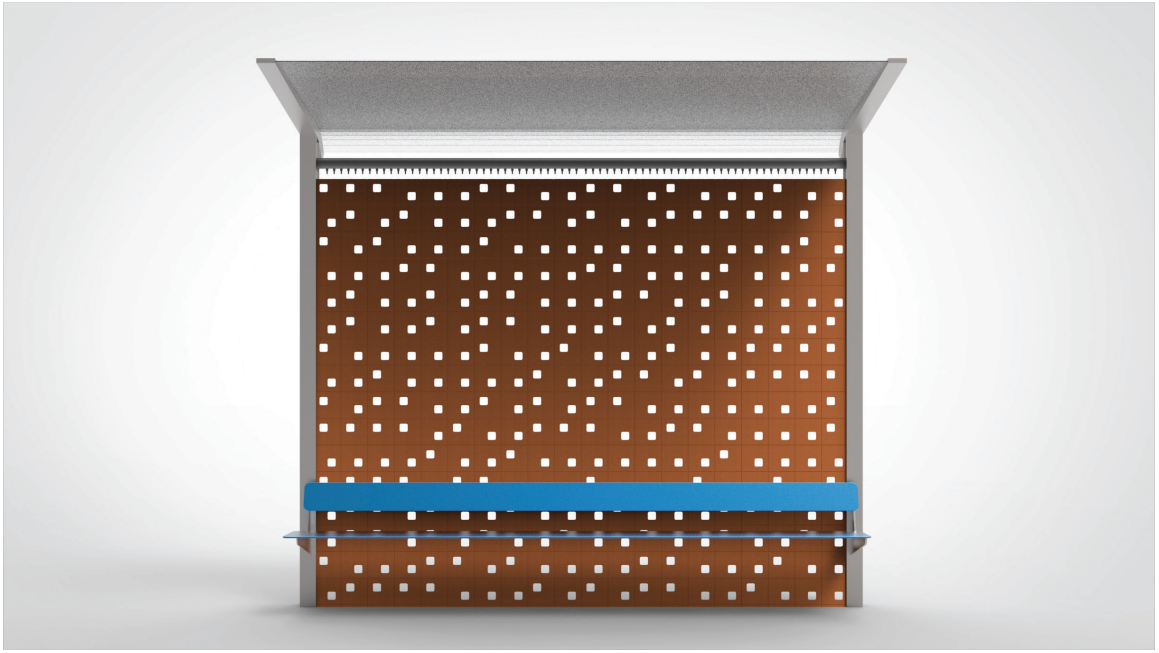


HOW IT WORKS

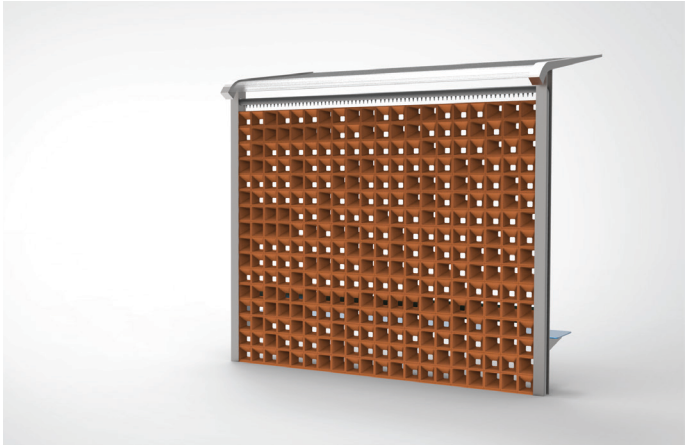
Water led by underground pipes is pumped to the top of the pillars. The water runs down the tiles, and expands sideways with the help of the marks (like in the vase I referenced).

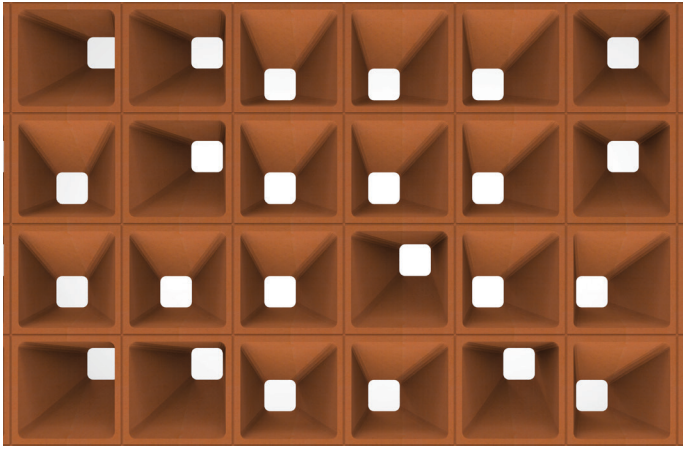
The water amound willl be adjusted to the duration ot the tile drying. Some of the water will inevitably run down to the ground, but since it will work in warm weather, I believe it will evaporatve quickly.

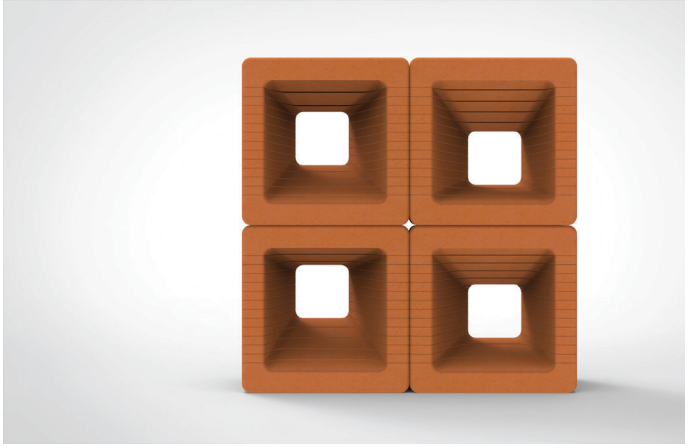




As part of the wall, a bench and sunshade are included, giving the passers-by an option to stop and enjoy the cool feeling.
The flow of water will be activated during the summer and will be stopped during the winter, in order to prevent water from freezing inside the bricks.







## IMPACT

The assimilation of WATERWALL elements throughout the city is one small step among the many steps required to cool down the city and make it a more sustainable and wholesome space. In addition to taking part in the urban cooling effort, the WATERWALL will be new element in the public space, which will invite passers-by to stop next to it, cool down and relax.

## PROCESS

I began my project looking for problems around the streets of Berlin. I got the feeling the urban layout and the architecture was quite adjusted to the winter climate.

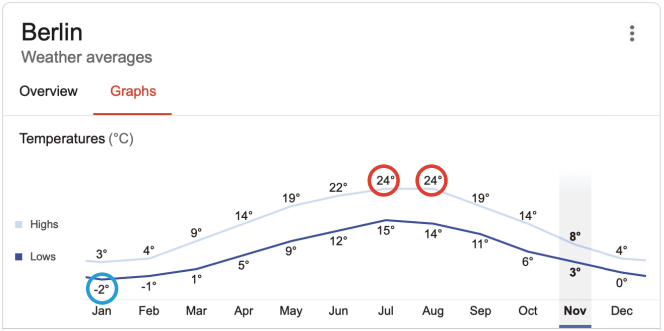
I then went over to check how the Berlin's public spaces are adapted to the summer, while being aware of the rising issue of global warming.
I researched more about the 'Berlin summer'. The main alarming fact I learnt is that the city isn't adapted to hot weather.
After learning this, I went over to check the weather predictions for the following years, and found out alarming facts. According to researches, until 2050 the average tempetarure in Germany  will rise by 1.8c, and during the warmest month, will likely rise by 6.1c.
This research got me to the understanding that the city of Berlin is about to experiance a segnificant change in the weather conditiond. A change which it is not prepeard for.
Since air conditioning and cooling technologies often consume a large amount of energy, I began working with the goal of finding a cooling system for the urban space which will be effective and use a relatively low amount of energy.

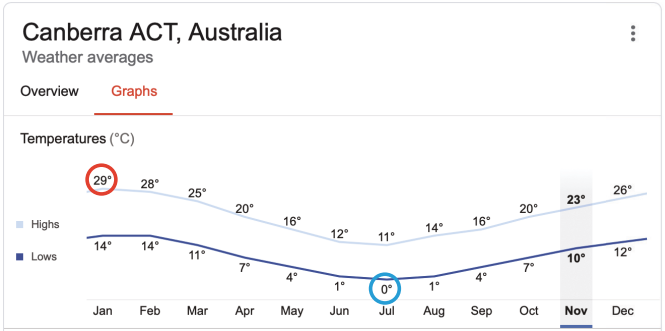
Global Warming

# in Berlin

By 2050 the maximum temperature in the warmest month in Berlin will likely **increase by 6.1C**, researchers say. That means the German capital will see a mean annual increase of 1.8C, making the climate most similar to current day Canberra, Australia.

https://www.thelocal.de/20190712/climate-change-berlin-to-be-as-hot-as-australia-in-30-years



## urban heat islands (UHI)

causes:

1. Low Albedo Materials
2. Paved and Impermeable Surfaces
3. Thermal Mass
4. Dark Surfaces
5. Lack of Vegetation
6. Climate Change
7. Increased Use of Air Conditioner
8. Urban Canopy
9. Wind Blocking
10. Air Pollutants
11. Human Gathering

Effects:

1. Increased Energy Consumption
2. Elevated Greenhouse Gas Emissions and Air Pollution
3. Poses Danger to Aquatic Systems
4. Discomfort and Danger to Human Health
5. Secondary Impacts on Weather and Climate
6. Impacts on Animals

Solutions:

1. Use of Light-colored Concrete and White Roofs
2. Green Roofs and Vegetation Cover
3. Planting Trees in Cities
4. Green Parking Lots
5. Implementation and Sensitization of Heat Reduction Policies and Rules

https://www.conserve-energy-future.com/effects-solutions-urban-heat-island.php

https://www.researchgate.net/figure/12-A-cross-section-of-an-urban-canyon-showing-simulated-variations-in-wall-T-wall-and_fig3_341786758

urban COOLing systems

## Opportunities

Sources:

1. coleccted rainwater
2. underground reserves
3. re-used household waters
4. rivers and canal systems
5. active human
6. in-house ratiator water pipes?

Spaces:

1. Building facades
2. Window
3. public spaces -
   parks, pathways, streets

Technologies:

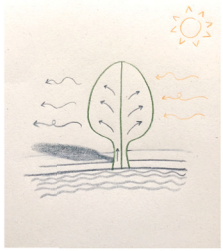
1. Capilary Effect -
   clay, paper, cloth, pipes
2. Solar energy
3. Human action

3. Planting Trees in Cities

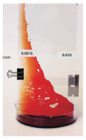
## COOL Tree

Mechanism:
Capillary Action

Benefits:
Cools the air
No energy/equivalent to fountains?
Shade





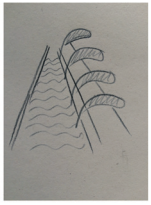


3. Planting Trees in Cities

## COOL Gates/Sahdes

Mechanism:
Capillary Action

Benefits:
Cools the air
No energy/equivalent to fountains?
Shade

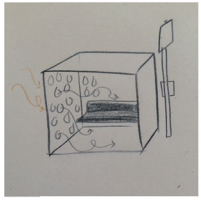


9. Wind Blocking

## COOL bus-stop

Mechanism:
Capillary Action?
3D printing?

Benefits:
Cools the air
No energy/equivalent to fountains?
Shade



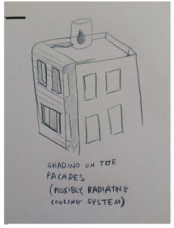


7. Increased Use of Air Conditioner

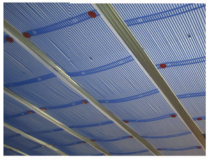
## Shade for the buiding

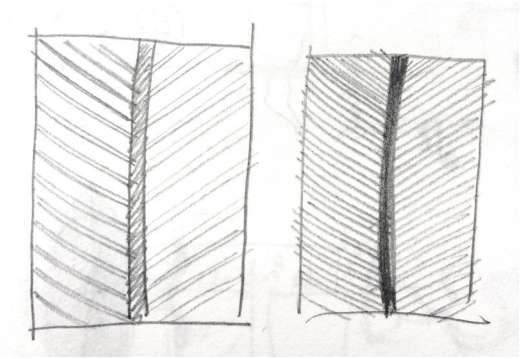
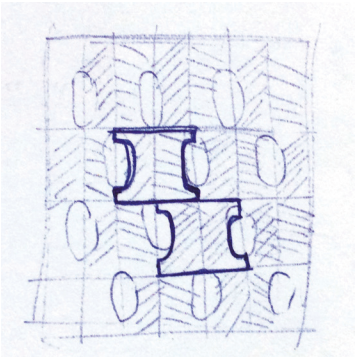
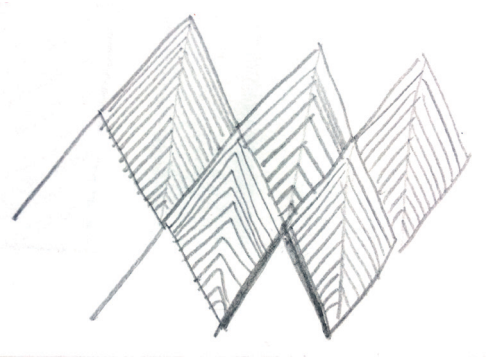
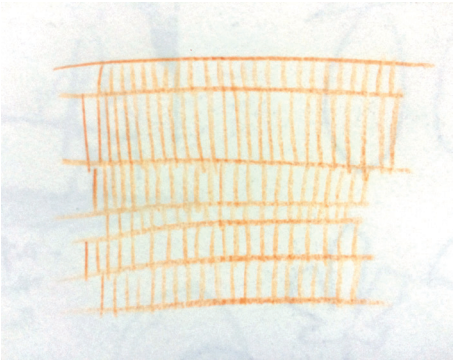
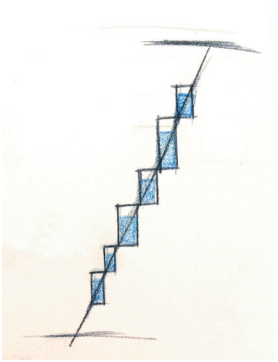
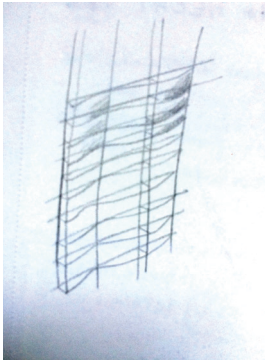
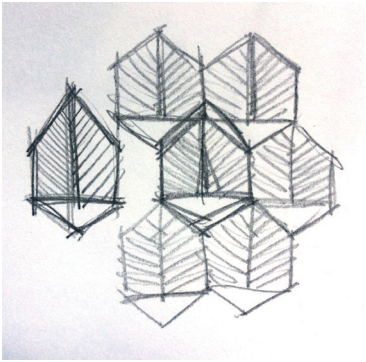
Mechanism:
Casted shadows
Cooling radiating system

Benefits:
Cools the air
vShade





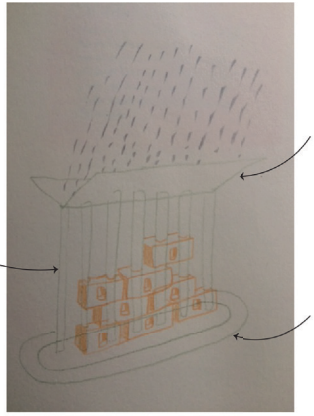
I continued my research by looking at solutions and technologies used in warmet regions for similar issues. One of the technologies I found very inspiring I saw in structures made out of clay or terracotta element. As long as these structures are kept wet, they helped significaltly with the cooling of their surrounding areas.

A good example for this thechnology can be seen in this cooling system designed by Monish Siripurapu in India. By stacking terracotta tubes and wetting them, the air hot air that passes through cools down, and significantly decreases the temperature in the factory it is place in.

Photo by Monish Siripurapu/Ant Studio

I chose to focus on this thechnology because it is enviromentally freindly and it uses material that are commonly found also around Berlin and other European countries.
After deciding about the technology, I began thinking of ways to integrate it into the urban space.

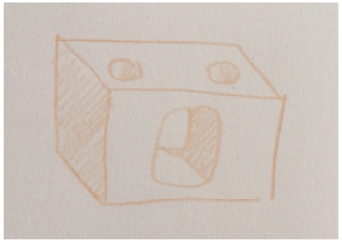
I was afraid that individual bricks piled up will not be stable enough, so I thought of having some king of a construction holding them together.



Some kind of a 'roof' or shade element on the top of the structure could help with collecting more water to the brick surfaces.

The base of the structure should be wide and preform as a steady base for the new "wall" of bricks.

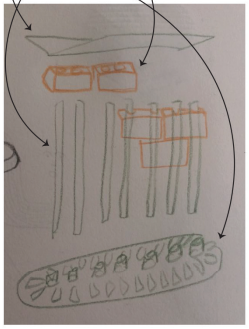
A very rough shape of the brick could be somwthing like this. having two holes for the pillars, and some kind of opening for the air and light to go through.

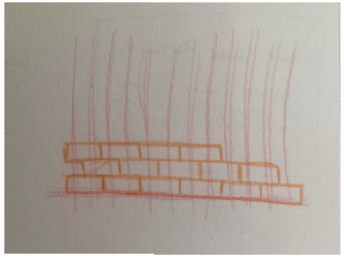


I want to find a way to use the effect seen here in the bricks. The thin lines carved in the clay become routs for the water diracting it to new places.

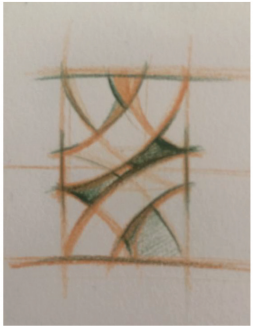
Using this, I could di ect the water that comes down the pillars to cover the brick's surface more efficiantly.

To be more of a practical and common object it could all be taken apart quite easily into segments: roof, pillars, base and bricks.

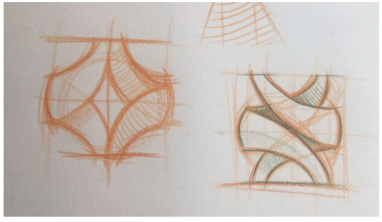




The brick patternv will in a way have a certain resemblance to classic brick walls, such as ones seen around Berlin and also in many places around Europe and the world.



I began thinking and sketching more complex brick shapes, but still have to think more about how the water will run down the pillars, where it meets the bricks, and what are the areas in each brick that dont get wet.




# ACT

Urban cooling structures

**Who?** Any person passing by

**When?** Short periods, in between, refreshment

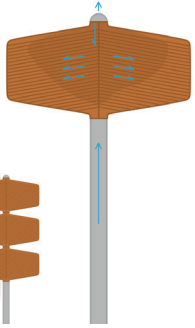
**Where?** Public spaces, parks

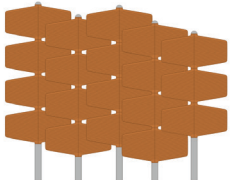
# Technology

Terracotta tiles that are constantly kept wet.

Shading

"Quiet Fountain"



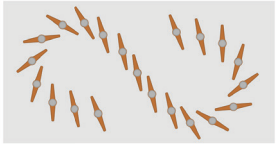


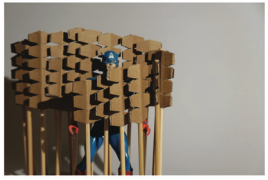
# Design

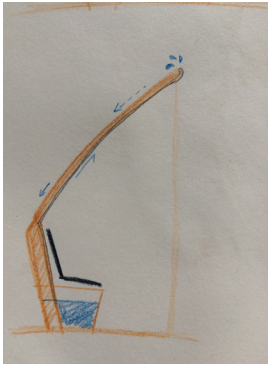
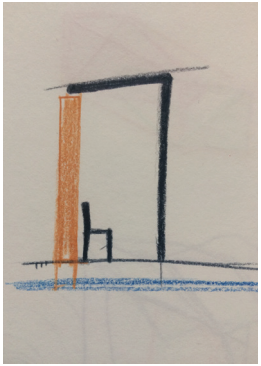
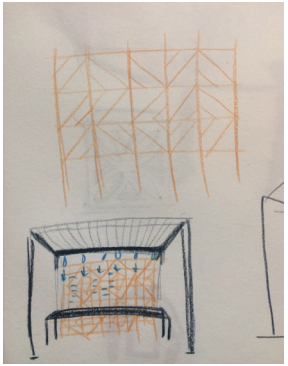
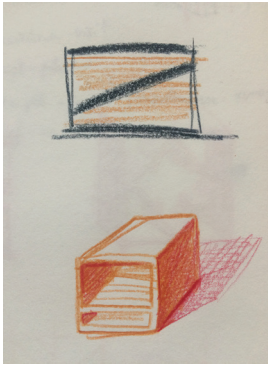
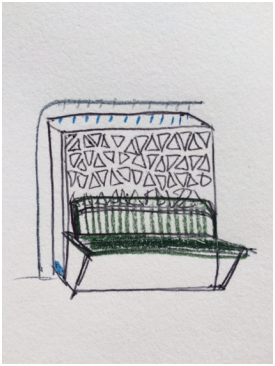
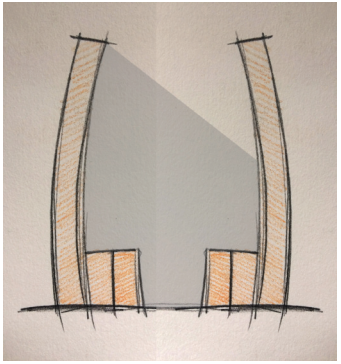
Close to the body

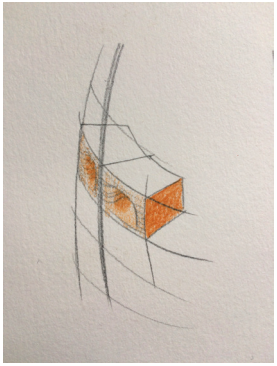
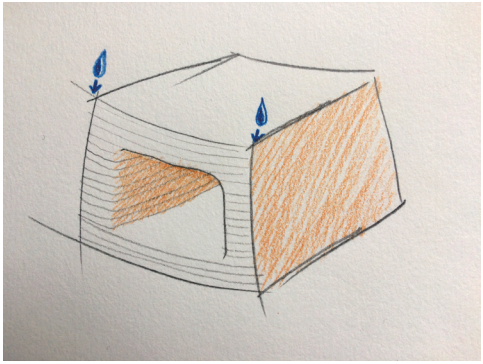
Private / public

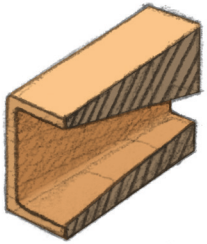
Interation to reality

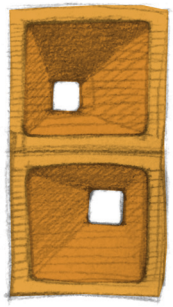


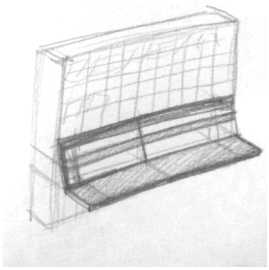


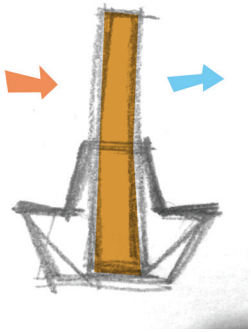







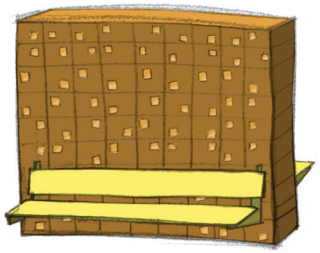



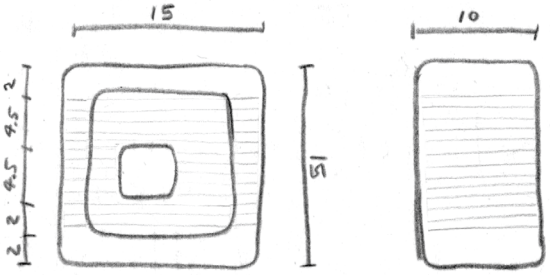








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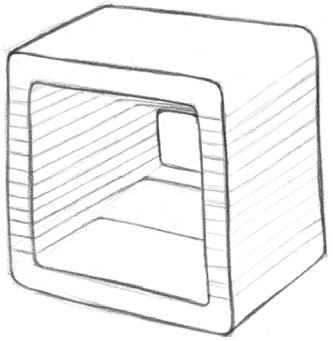
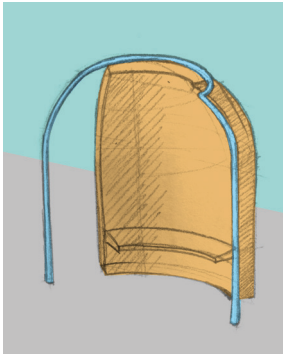
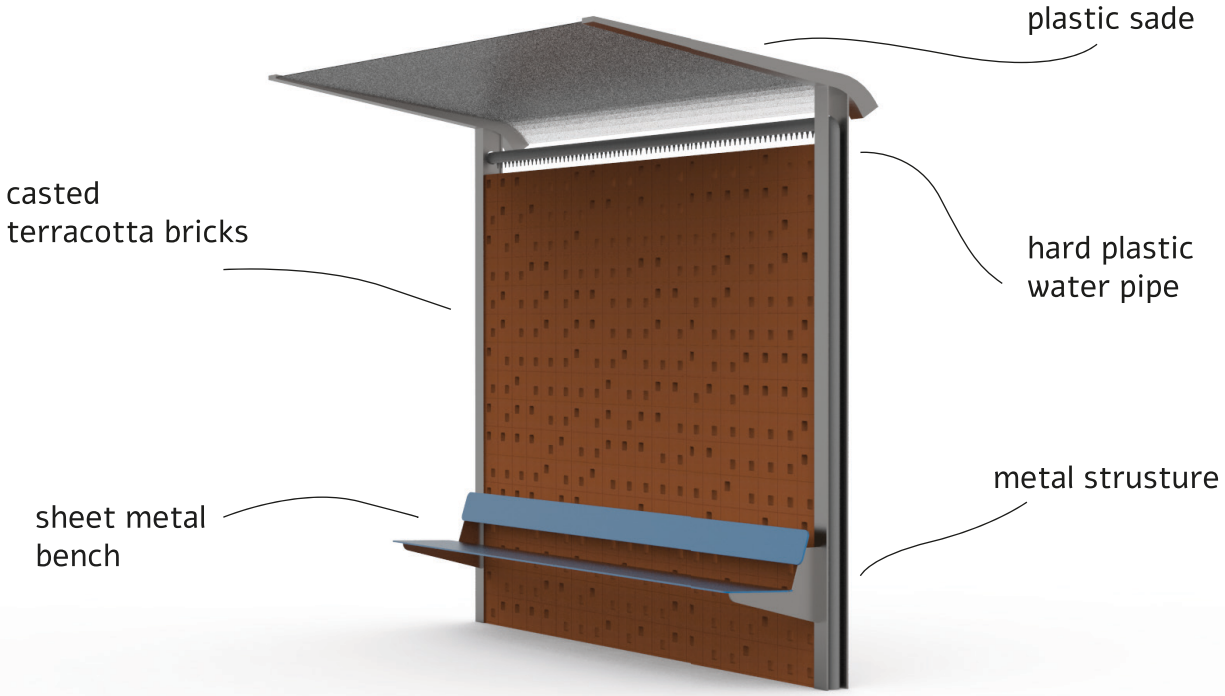
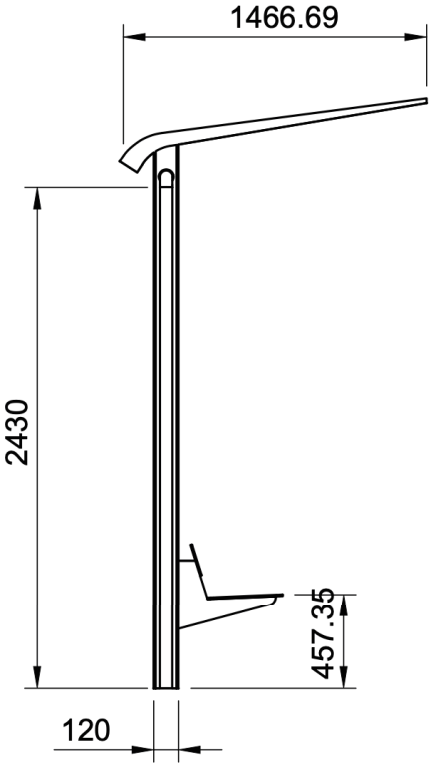
10
51
2
9.5
9.5
2





# PROPOSED MATERIALS

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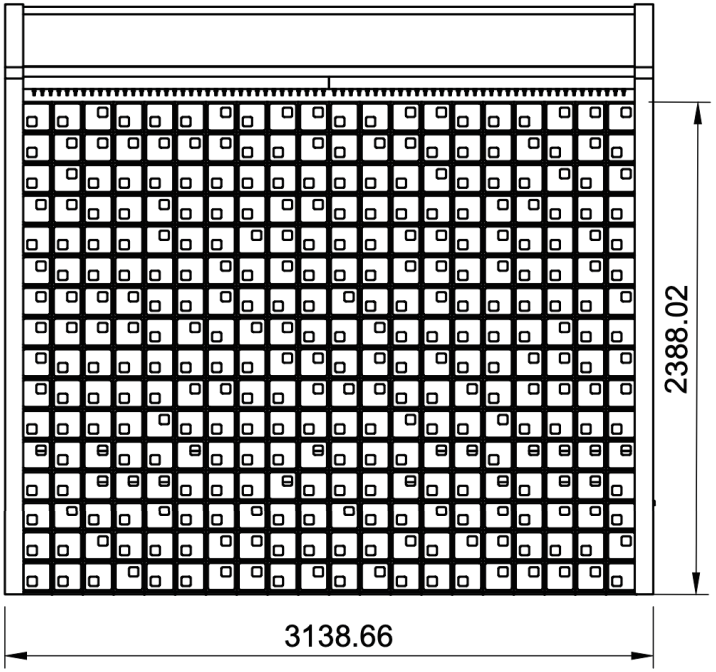
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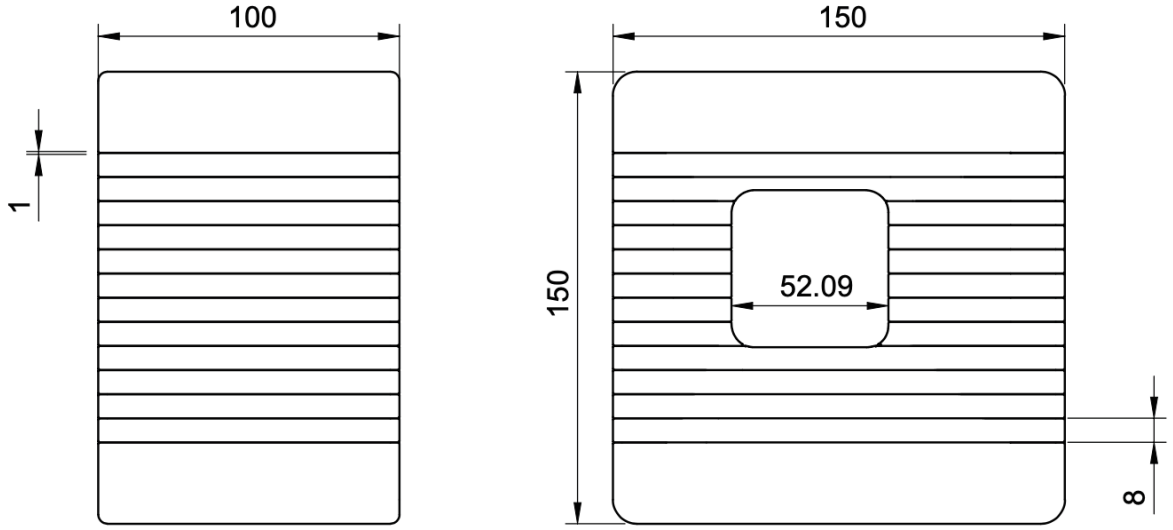
3138.66


100
1
150
150
52.09
8

# WATERWALL

## Low energy cooling element for urban public spaces

**By Alma Abrahamson Mintzi**

Design & Social Context
UdK Berlin – WISE 2020
Prof. Ineke Hans

Universität der Künste Berlin

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