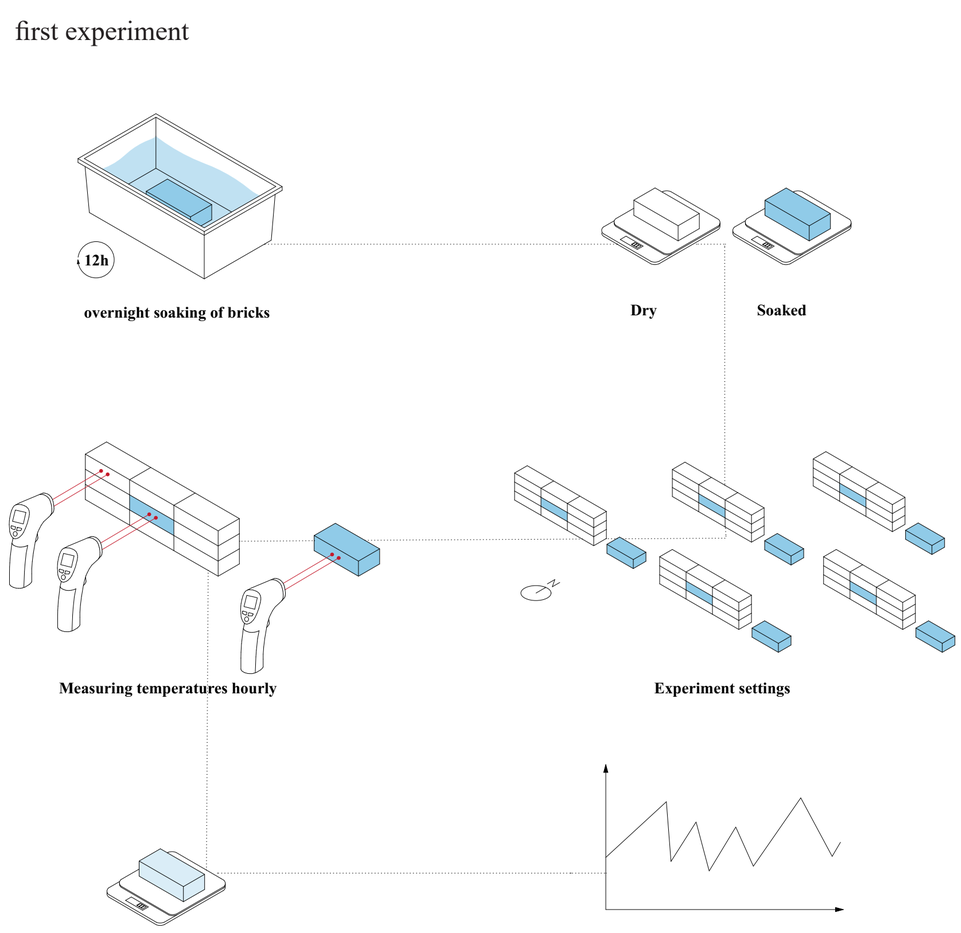
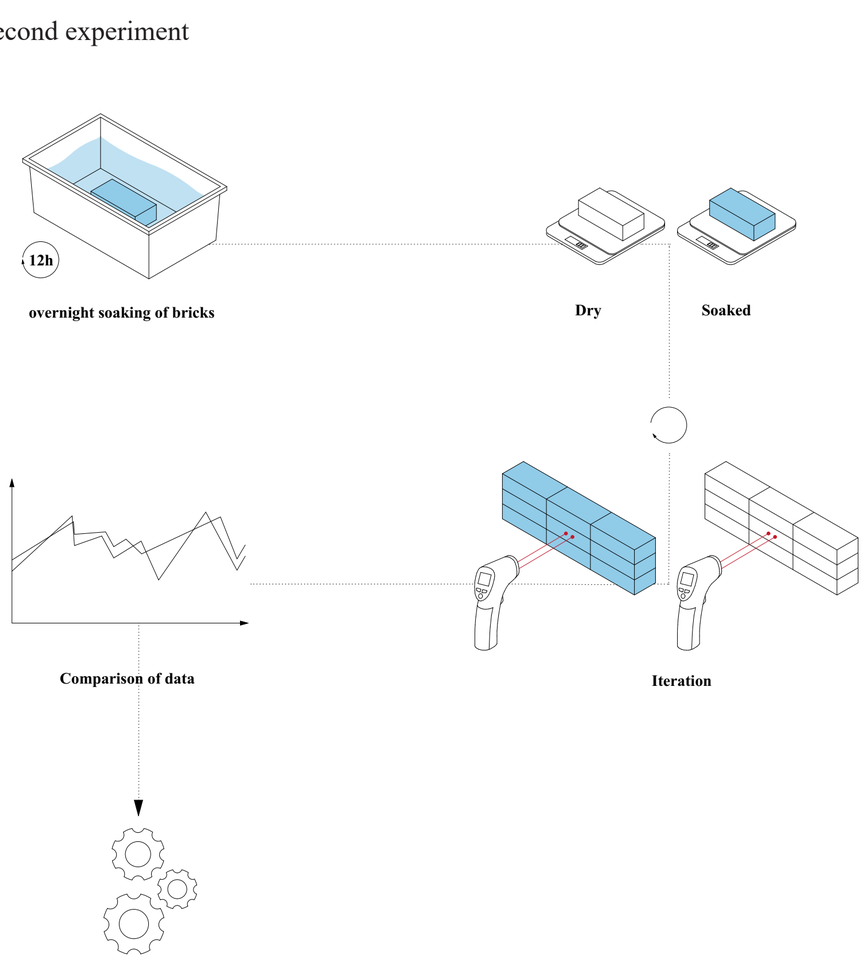
Adaptive Bricks

Evaporative cooling of bricks to prevent overheating of urban microclimate





Introduction
Even cities like Munich are affected by urban heat island effect. Densely built up urban districts with asphalted streets and minimal street vegetation show to have significantly higher air temperature than rural areas. Buildings have been large contributors to the phenomena of heat urban island effect because their surfaces absorb solar radiation which heats up the surrounding areas. Therefore, the choice of materials used in building façades plays a great impact on the microclimate of urbanized streets. This project investigates the potential of evaporative cooling of wet bricks and whether using them as a building envelope will help reduce impacts of heat urban island effect.

Methodology
For this experiment 5 types of bricks with the following properties were selected:

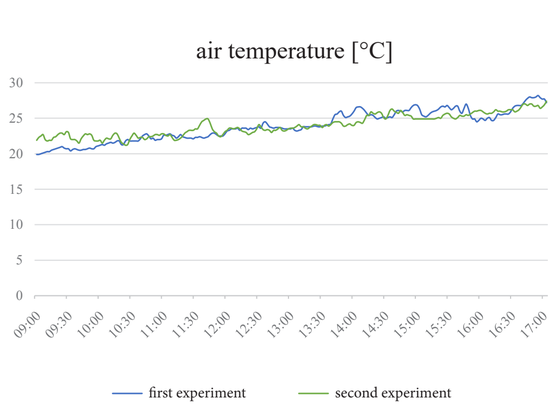
- Brick dimensions: 24 x 11.5 x 7.1 cm
- Water suction capacity: 1 - 7% depending on the color (white/black: 2% | light red: 4%)

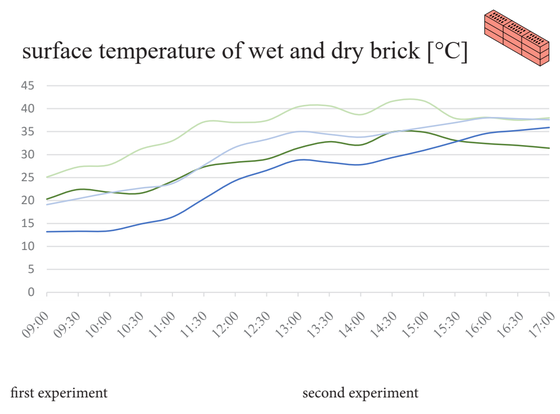
The evaporative cooling features of different types of bricks are to be compared as a part of the experiment.

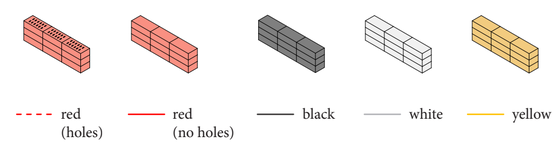
The **first experiment** was carried out in the following way:
Five walls out of different bricks were positioned on the roof of TUM. Each experiment consisted out of 10 bricks; of which 9 made up the tested wall and one was tested independently under the same weather conditions to see the full evaporative capabilities of a singular brick. Therefore, two bricks were left to soak in water tub overnight to have a maximum water content. The bricks were weighted before and after they were soaked. One soaked brick was positioned centrally in the wall surrounded by 8 briefly wetted bricks. The other soaked brick was tested individually. The brick in the uperleft corner of the 9 bricks in a wall was also measured.

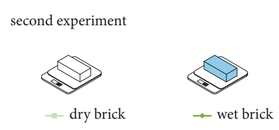
The **second experiment** was more precise. The bricks around the one in the middle had have more surface exposed to the sun. So the second time was about to compare a wet and a dry brick with exact the same conditions: each in the middle of a 9-brick-wall. Instead of hourly measurements the bricks were monitored every half hour. This time the weight was also taken every half hour.

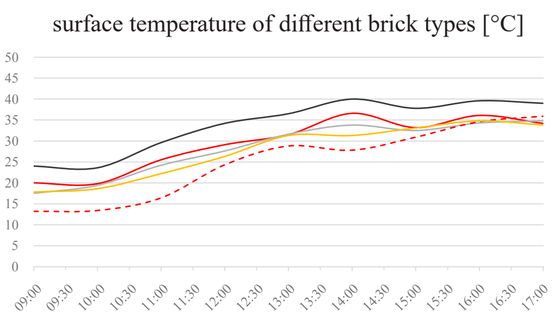
Conclusion
The experiment showed that soaked bricks can decrease surface temperature significantly. In the second experiment in average about 7 °C. However, the color of the bricks is also influencing the temperature curve. Between the white and the black brick there was an average temperature difference of about 5,4 °C. As a result evaporative cooling of bricks in facades could reduce the urban heat island effect.

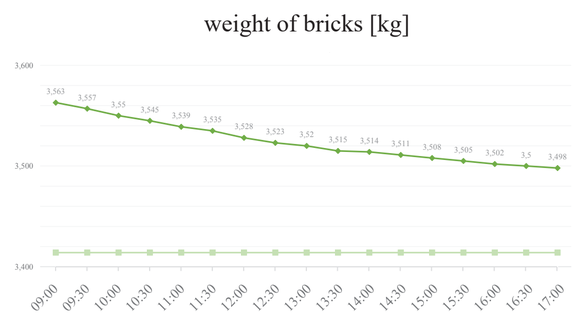












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