# Visualization team 8 temperature data

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## Abstract

The university of Vienna has done some studies on temperature data of the faculty building for information technology and journalism to show the temperature and the temperature changes over time in different parts of the building. Our Visualization, using two heatmaps, allows for an quick overview and a detailed breakdown for each day. Thus patterns or points of interest can be identified.

## 1 Motivation

The given data displays temperature measurements over the course of four months in the summer of 2013 in the faculty building for information technology and journalism in Vienna. Measurements were taken every half an hour. The given dataset contains over 60.000 entries. Each entry corespondents to one measurement and consist of an individual id, the date, the time, one of eight rooms (room 1 being the outside), the temperature in Celsius, “reale Feuchte” and “Taupunkt”. Therefore this project deals mostly with continuous, abstract values.

We want our Visualization to allow for exploration of this big dataset and discovery of how temperature development works in the building.

Our goal is to provide a clear and easy overview of the temperature data of the faculty building, but it should also be possible to “zoom in” and see the temperature development in a more detailed manner. The user can see individual values hour by hour and can compare the temperature of different rooms. The user should not get confused, so the visualization has to be easy to understand.

It is hard to accomplish this visualization with existing standard tools because the dataset is really big. You can't display the amount of data without loosing a lot of important information.

## 2 Related Work

As a template for the detailed view we used “Day/Hour Heatmap” by tjdecke [1] We modified this solution so that it doesn't display a complete week but instead a single day for several rooms.

As a template for the overview we used “Calendar Heat Map” by Wan Chen [2]. We choose this plugin because it takes care of some data preprocessing.

We linked the solutions together to provide interactivity and modified their look to create consistency.

## 3 Approach

The first step was to preprocess the given dataset. In the beginning we decided to get rid of the “reale Feuchte” and “Taupunkt” data. These values influence how temperature is perceived by humans. But we couldn't find a way to display this influence in the visualization in a way that could be easily understood by users not familiar with the physics of temperature perception. Measurements were taken every half an hour. We combined two values to get an average for every hour. We decided that 24 instead of 48 values per day are simpler and more natural look at a day.

We then went through several prototypes until we found our final solution. The first idea was to use a line graph visualization similar to those of climate diagrams (figure 1). But came to the conclusion that these are only well suited for a raw overview over long time periods and average temperatures. They become cluttered quickly in a detailed view, especially with the several rooms we have to display.

For the next iteration we split the visualization into three views, each more detailed (figure 2). The first and second showed accumulated temperatures for weeks and days respectively. The third hour by hour. The third view was great for an detailed look at the data, but the first and second fell short at providing an overview, as they were still to cluttered and not natural enough.

In another prototype we experimented with a calendar like view, with the date replaced by the average temperature for the day (figure 3). While the date can still be deduced through the commonly understood form of the calendar.

In the end we combined elements of our different prototypes for our final solution. There is a calendar like view in the top, showing average temperature for each day. Clicking on a day reveals the second view, which breaks the day down in 24 hours and the different rooms. Booth use colour to decode the temperature. This is a common and easily understood principle. On hover the temperature is revealed as a number.

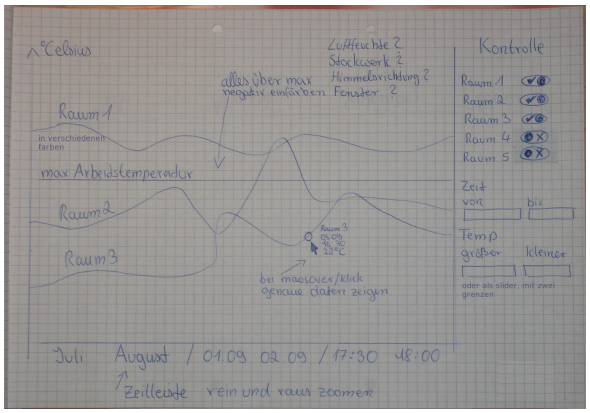
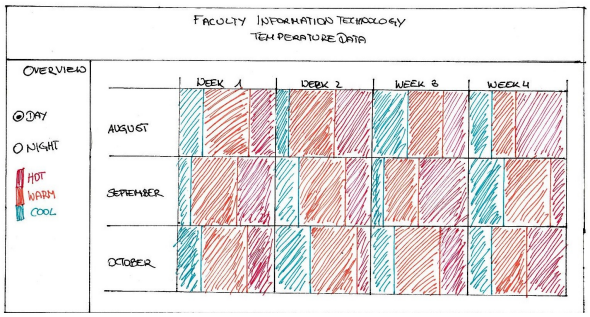



Figure 1: Mockup with graphs



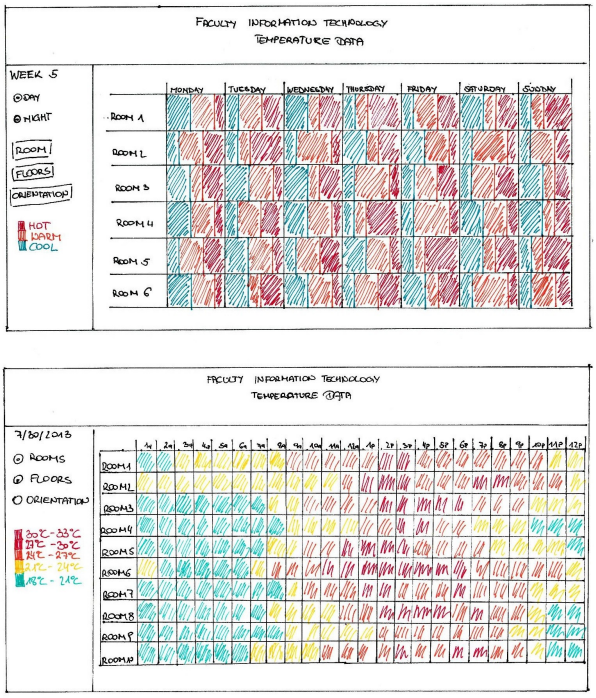



Figure 2: mockup with three views

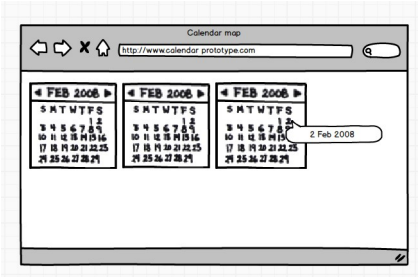



Figure 3: calendar mockup

## 4 Implementation

Our system is realized using JavaScript and HTML. Thus being cross-plattform available through a browser. We used the JavaScript library D3, because it is a comprehensive visualization. D3 gave us the possibility to be flexible during implementation.
The implementations mentioned in related work acted as a basis, as they were well suited for our goals. The whole solution is hosted on a simple server.

## 5 Results and Discussion

Example Scenario: The director of the University of Vienna wants to know if it is necessary to get an air conditioner for the faculty building. Therefore he starts our temperature data visualization tool. At the beginning it shows a calendar view where the values of the average temperatures of the days get displayed on the calendar (figure 4). After clicking on a special day a more detailed view shows the distribution of the temperature within the rooms over a day on a heatmap (figure 5). By clicking on another day our heatmap view updates and shows the corresponding data so it is possible to explore the data.

We are confident that our solution manages to achieve our goals: a quick overview and a detailed breakdown for each day. The big and complex dataset was simplified and divided into smaller pieces. This also helped with performance. The tool is easy to use and doesn't need any explanation to what is shown. This is achieved by using common principles (colour for temperature, calendar for time). It is an easy way into discovery and light exploration of the dataset.

This is, at the same time, the shortcoming. It doesn't feature any possibilities for advanced actions. Once an interesting pattern or point has been identified other possibilities must be used to investigate further. We also didn't manged to implement any filters as we planned to in the beginning. All rooms and hours of the day are always shown.

The project was a new experience for all of us. We have learned more about d3 and we noticed how difficult it is to work with dataset that have reached a certain size. The feedback of our lecturer and the work on our first prototypes made us realize some weaknesses and the complexity. So we had to revise our solution completely and scrap some ideas.

But all in all we are content with our tool that allows for a quick dive into the dataset.

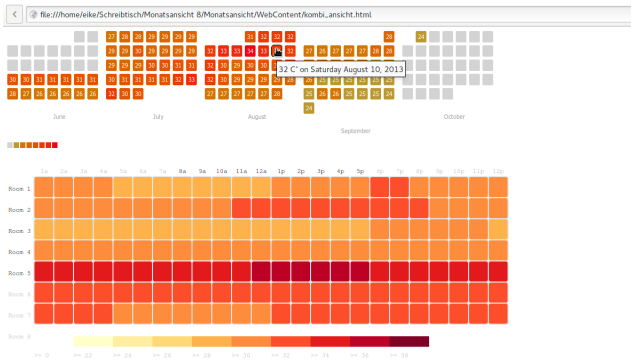



Figure 4: Detailed info on hover

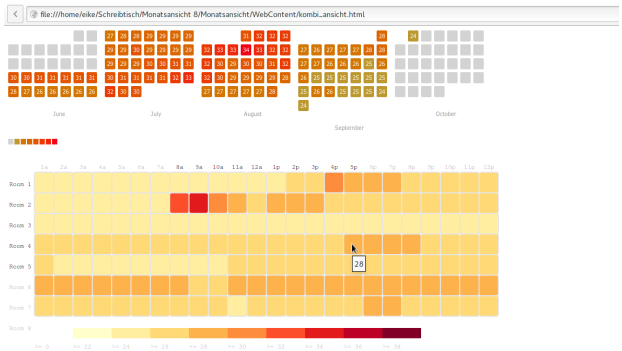



Figure 5: Click on calendar changes detailed view

## References

[1] tjdecke. *Day/Hour Heatmap*. Retrieved from http://bl.ocks.org/tjdecke/5558084

[2] Wan Chen. *Calendar Heat Map*. Retrieved from: http://kamisama.github.io/cal-heatmap/v2/