



Data Visualisation Documentation

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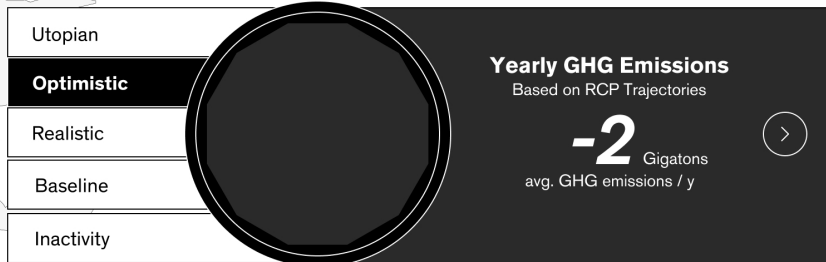
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Introduction

In this data visualisation module, we delved into the basics of visualizing data, beginning with short exercises, then proceeded to code an interactive application for an multitouch table.

The goal was to inform about the problems of climate change, visualize its impacts and showcase certain solution scenarios which could improve the outcome of the climate crisis we are facing. We worked thogether with the crowther lab to acess the data we needed.

	Trees	Year
-2 gt/y	100%	2020



What are these Emission scenarios?

A Representative Concentration Pathway (RCP) is a greenhouse gas concentration trajectory model adopted by the IPCC (Intergovernmental Panel on Climate Change).

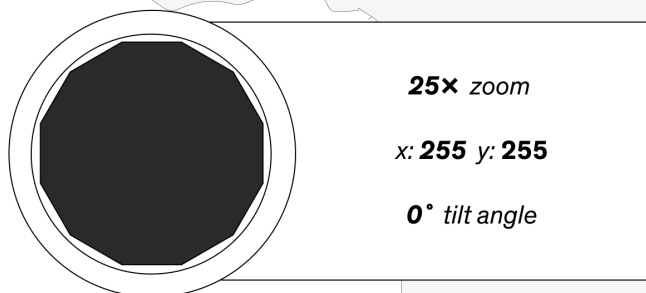
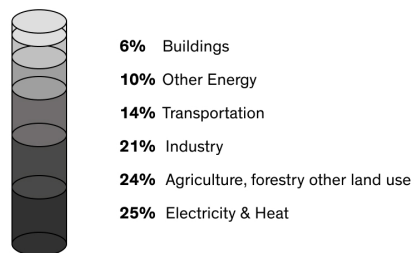
The pathways describe different climate futures, all of which are considered possible depending on the volume of greenhouse gases (GHG) emitted in the years to come.

Utopian / RCP 1.9	➤
Optimistic / RCP 2.6	➤
Realistic / RCP 4.5	➤
Baseline / RCP 7	➤
Inactivity / RCP 8.5	➤

The optimistic scenario RCP 2.6

RCP 2.6 is a "very stringent" pathway. It requires that CO₂ emissions start declining by 2020 and go to zero by 2100. Like all the other RCPs, RCP 2.6 requires negative CO₂ emissions (such as CO₂ absorption by trees). For RCP 2.6, those negative emissions would be 2 Gigatons of CO₂ per year (GtCO₂/yr). This scenario is likely to keep global temperature rise below two degrees by 2100.

Where are GHG Emissions coming from?



Concept

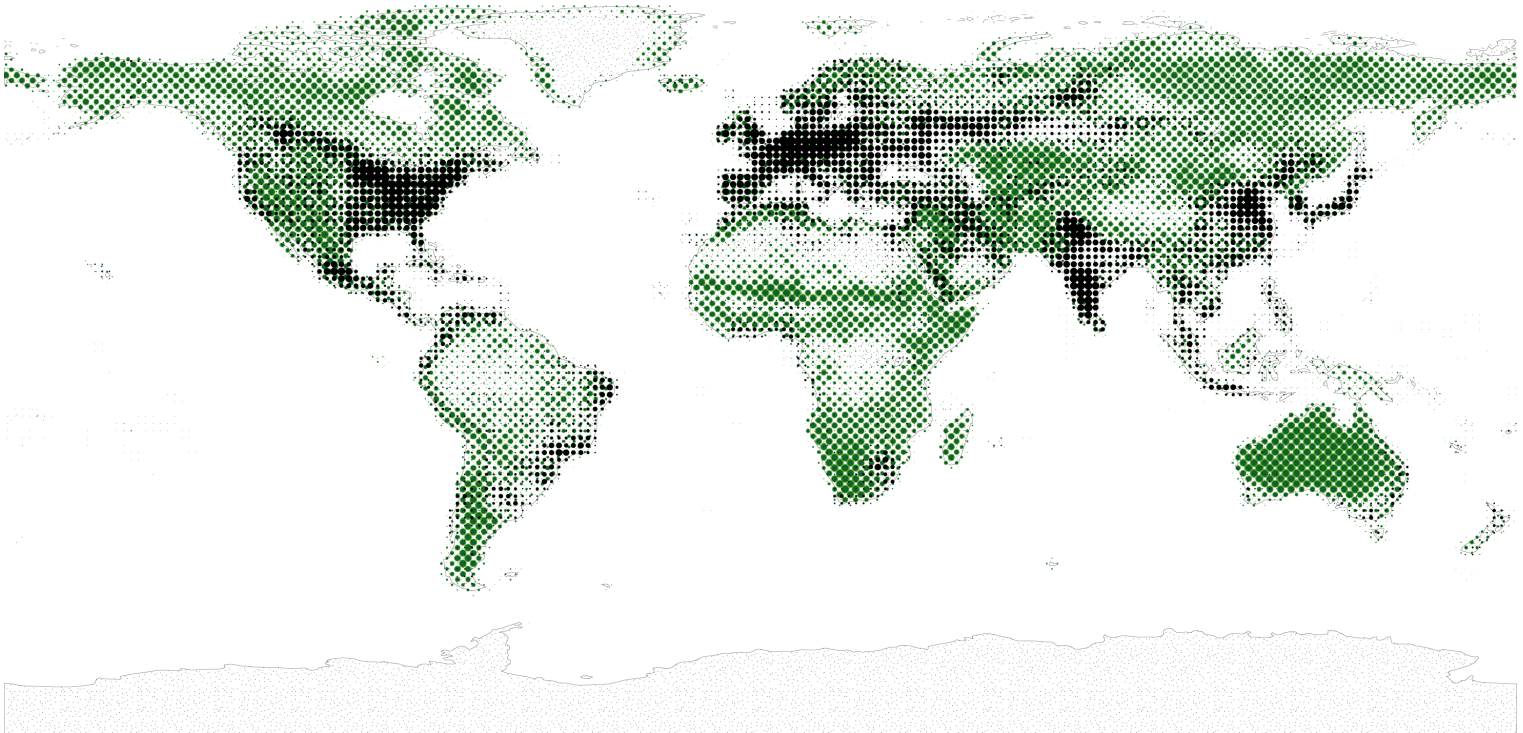
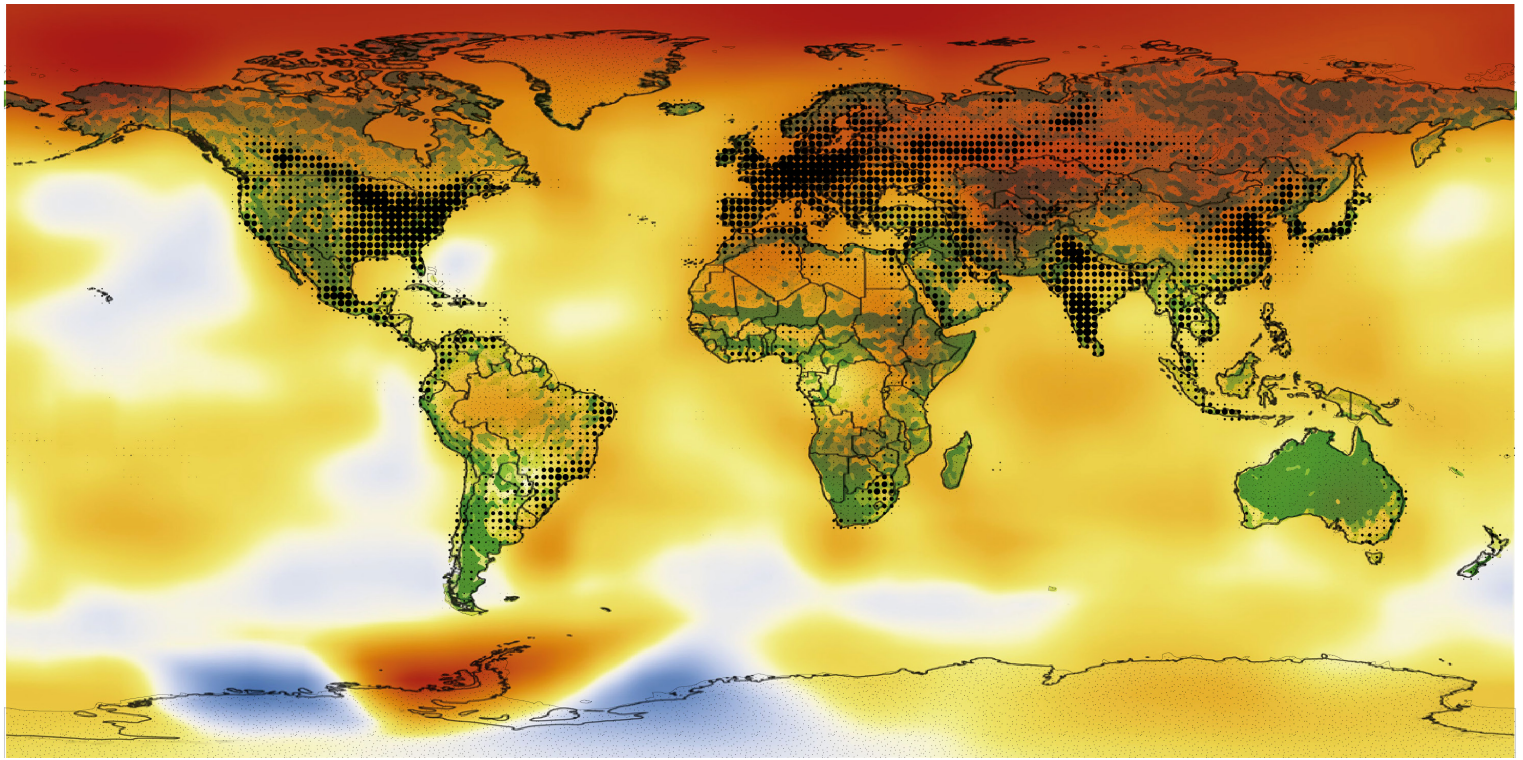
The task for this exercise was to create an interactive visualisation, possibly working on the touch table, which enables the viewer to learn about the impacts of climate change on our future climates, how greenhouse gases accelerate this process and learn about some possible solutions for slowing global warming.

Our reservation with this task was the lacking of context and quality in the information situation, which cuts away on the complexity and urgency of taking action against climate change.

The touch table aims to make visualisation more tangible. It can be controlled by the touchscreen, and has an inbuilt IR-tracking function to control the table with physical tokens. Theoretically you could use a multitude of tokens to interact with the table, but only two of three were operational, which we had to keep in mind for designing the interaction with the table.

In the ideation stage of our process, we stepped back to square one to think about what information and data we wanted to visualize with the table. Our first raw concept wanted to give up the classic storytelling through a Map and make the data accessible through a character that would be impacted through climate change and the loss of biodiversity, thus showing the underlying issue in a more accessible way than with abstract maps.

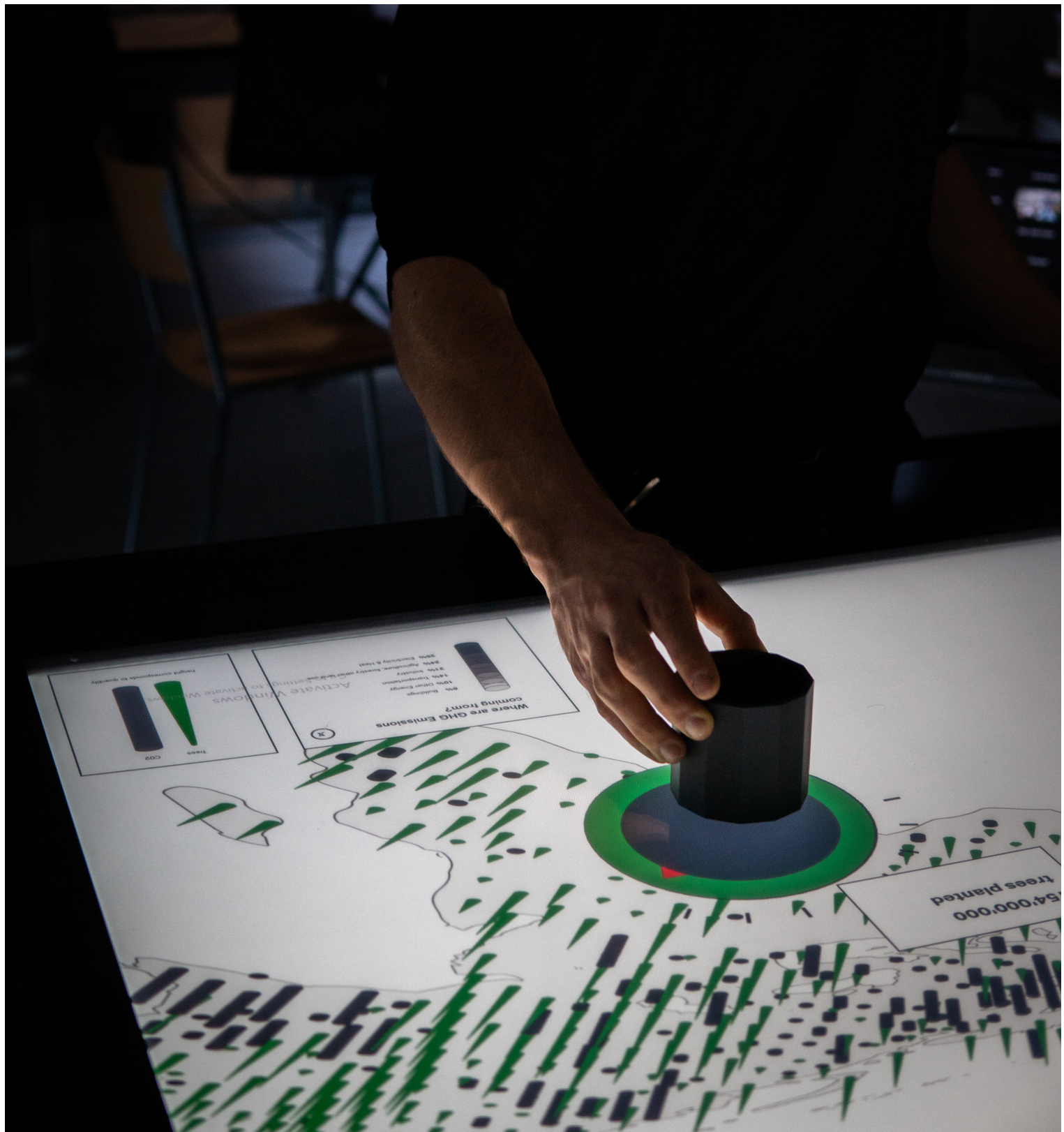
Then the first mentoring came. We realised that we had effectively 6 working days to realize our concept. The decision was made to proceed with the template provided and focus on visualizing the basic data of future GHG emissions and its impact on global warming, and proposing reforestation as a solution through its CO₂ soil binding potential.



Data & Maps

The definitive concept we developed was based on the idea of a hypothetical time travel, where the global warming till 2050 is visualized using a heatmap, and animated through the time parameter. The heatmaps scenarios would have changed based on the chosen emission and reforestation parameters.

Due to time shortage and difficulties with the code, this concept was only partially realized. The actual functionality consists of the ability to change the reforestation potential used, which then impacts the GHG emission.



Interaction

There are two ways of interacting with the table, the more obvious being the touch functionality, and the latter being the use of the so-called tokens. These are effectively cylindrical-shaped objects with built in infrared lamps to allow for tracking through an IR camera. The IR-tracker software provided reads out the tokens' rotation angle and its XY position in a field that is marginally larger than the table.

In reality these tokens and their software had some flaws. Interacting with them intuitively did not work out well because the users hand would obstruct the infrared light and thus the tracking. Then there was a reset problem that would mess with

the trackers ID after reset, which made it difficult to show the token interface reliably and repetitively.

The interaction we decided to use for our application was a combination of both. The physical token would always be followed by a token-control interface which would explain its controls and show the parameters currently set.

Having just two functioning tokens, we decided to use one token to control the data parameters and the other to control the point of view. The «parameter token» therefore needed a functionality to switch between the three different data settings. And the «view token» to control zoom, position and view angle.



Interface

We decided to use a 2.5D map for visualizing the data. In comparison to the already existing 3D globe visualisation, we saw an advantage in clarity and understandability.

The two physical tokens had to have a visual representation on screen to visualize their purpose and data parameters. The navigation token uses its screen position data to change the camera position. Its rotation is controlling the zoom scale, and there is a touch button attached to its interface for a perspective change between 2.5D / 2D.

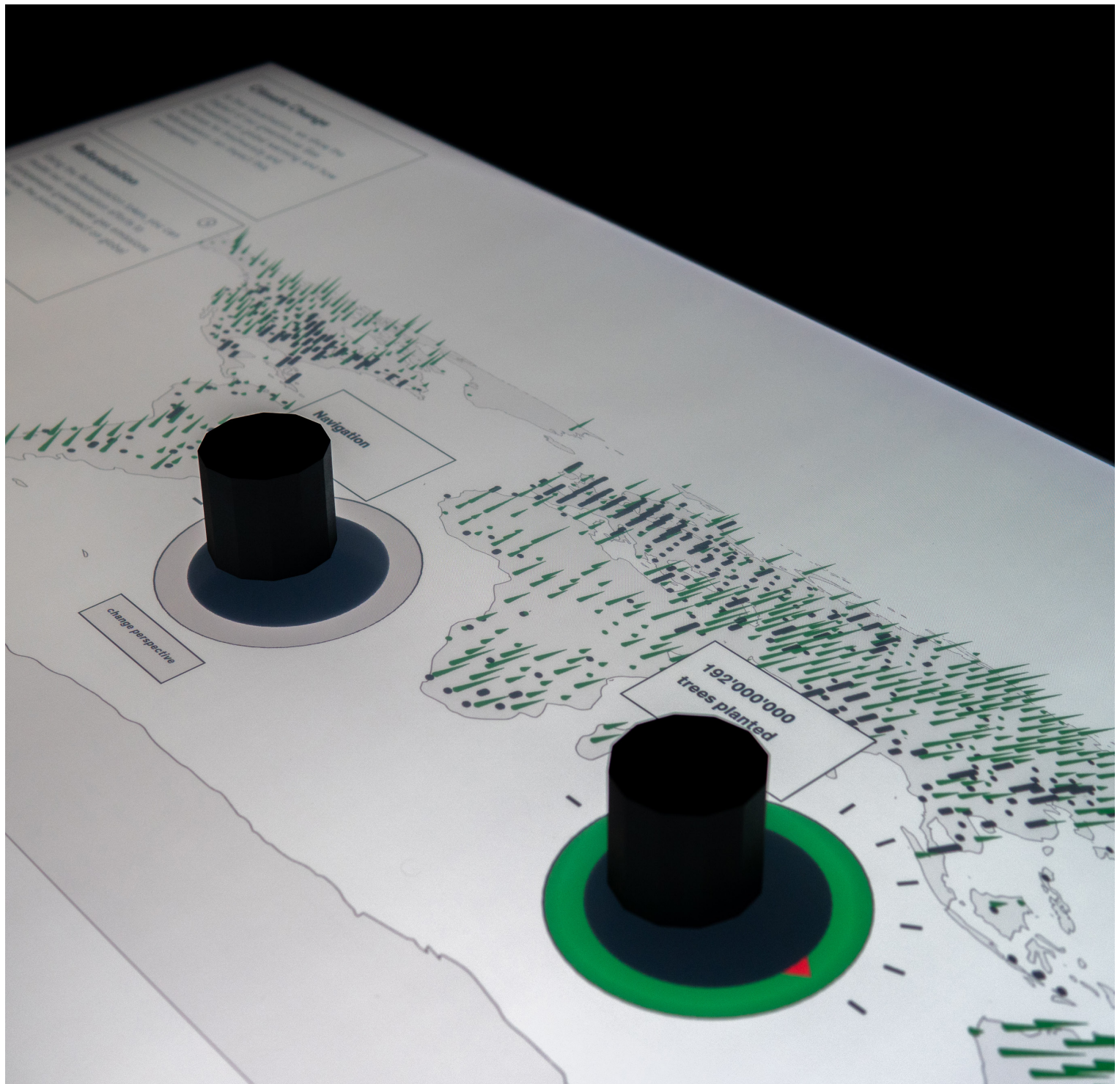
The data token was originally dedicated to control the three data parameters that we wanted to visualize on the map. For that purpose, we imagined three color coded buttons for switching between the parameters. Each parameter would have had a separate window in proximity to the data token, showing the value range, the chosen value, some small information and a button to open a window with further information about the data

parameter.

The visual language was chosen with simplicity and understandability in mind. Knowing, that we had to programm / use images for every GUI element, we decided to keep it as reduced as possible. The token is underlayed with a reactive element to visualize the interaction with the physical token. Its «oven» appearance is justified in the established and well understood language of a control dial.

We decided to use a color code for our visualisation to allow the user to quickly differentiate between the emission and the reforestation parameter. Black and green presented themselves as the most natural choice.

The emissions were visualized with a black cylinder, which changes in height, and the reforestation potential was visualized with a green cone. Both were arranged in an offset grid to evade collision between the objects.



Code

We were provided with a template to base our work on, which was helpful as a tool to quickly develop visualisation ideas and testing the interaction of the table, but definitely had its difficulties. It was written in P5.js / node.js which are languages that not many in our class had experience working with. The code part of the project occupied one person in the group for the whole project, and in case of serious problems / issues could only be solved with the help of a more experienced classmate. The tutors who wrote the code were many times absorbed by other projects, so the problem solving was usually not that easy.

Most of the interface was created in HTML to allow for easier formatting in a CSS file. The interaction between HTML and the Javascript code was fairly easy, and was implemented in the finalisation stage of the code.

In this visualisation, we show the impact of our greenhouse Gas Emissions on global warming and how activism for biodiversity and reforestation can impact this development.

By conserving and restoring Earth's ecosystems in ecologically responsible ways, we have the potential to positively impact global biodiversity, climate change and human wellbeing.

Using the **Emission** token, you can choose the development Scenario of our Emissions until 2050. These scenarios impact the global warming shown in the heatmap.

Using the **Reforestation** token, you can model our reforestation efforts to compensate greenhouse gas emissions and see the positive impact on global warming.

Using the **Time** token, you can move forward in Time to see our yearly GHG Emissions, their impact on global warming and how Reforestation efforts can positively change the outcome.

Using the **Navigation** token, you can zoom in on particular areas, tilt and rotate the map and change the perspective.

Trees

CO2



height corresponds to quantity

Reflection

Looking back at our project, the group worked out well. We divided the workload into coding / interactivity and design / data research tasks. Sometimes one person would delve into the other persons problems, and try to exchange look at the problem from another perspective. At the beginning of the module, our motivation was quite high, but went down when our concept momentum was halted in the mentoring.

We are quite happy with the fact that we got a working prototype, but nevertheless we have many features and ideas that did not make the cut in the short timeframe.

General improvements could be made on the legend, the information & data depth, the code optimisation, the GUI and we could have spent more research on visualising data on the map.

In the end, we had to compromise on different functionalities that we originally intended to implement. Nevertheless we are quiet satisfied with the outcome. Due to the «keeping the concept simple» feedback and our general feeling that deep research and deviation from the basic task guidelines were not encouraged, we declared the working prototype as our goal and put everything else on lower priority.