Data Visualization 2021
Dokumentation

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Lecturers: Jürgen Späth, Marcial Koch

Ideation & Research

In the first steps, we tried to read up on the topic of Co2 emissions and do some general research. Using mind maps and brainstorming methods, we then tried to get an overview of our research and the knowledge we had gathered about the problem of global warming and the various connections. Gradually, a number of topics emerged that we considered to be the most exciting. These included: the ever-increasing population growth, the release of naturally stored Co2, the Co2 emissions of large companies compared to individuals, the Co2 emissions in connection with digitalisation, the emissions of the richest 1%, biodiversity and its endangerment, the Co2 storage in the earth, the oceans, the trees and the permafrost.

Interesting topics regarding CO2 Emissions:
+ Population growth
+ Release of CO2
+ Corporations and their emissions
+ CO2 emissions in relation to digitalization
+ CO2 emissions of the richest 1%
+ Co2 storage in soil, ocean, trees, permafrost
+Biodiversity

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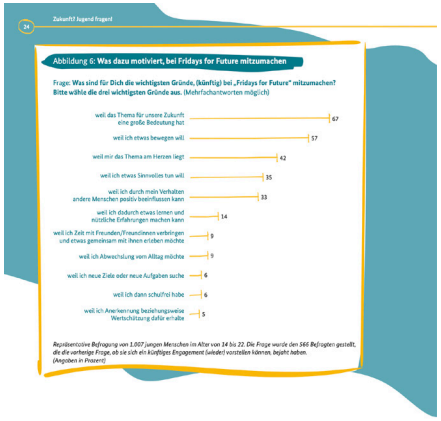
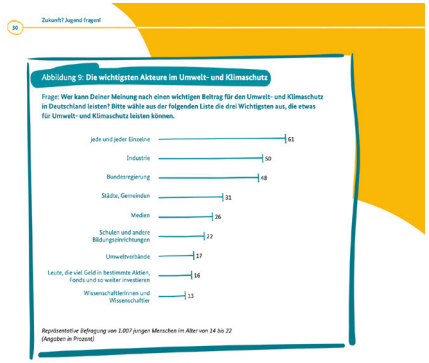
What keeps the youth busy?

In a further step, we tried to take a closer look at our Traget Group: „The young people of today“. Which topics related to global warming are of interest to today‘s youth? What and how do the climate youth think? What do they consider important and which issues are at the forefront of their minds? In many existing surveys, we tried to find out whether a topic is particularly controversial or important and how young people think about global warming in general.





Interview

Eleonora was asked by two 16 year olds to do an interview about climate as part of a school project. We immediately used this opportunity to talk to them about our project. What do young people care about? Which topics do they find interesting? Topics such as nutrition, traffic, etc. were very topical for them. They didn‘t know much about data consumption, and they weren‘t aware that data consumes an enormous amount of electricity. That‘s why we chose this topic. To create awareness and to talk about a topic they were familiar with, but didn‘t know the consequences.

SCENE #: | SHOT #: | SHOT SIZE:

Thema 1: **Was sind Klimafolgen?**
Was für Klimafolgen kennst du?
Mit welchen bist du schon in Kontakt getreten?
Fragen an Eli: Weisst du noch welche Klimafolge dir als erstens aufgefallen ist?
Skript zu «Was sind Klimafolgen»

Was war Ihre erste Erinnerung, wo Sie mit Klimawandelung in Kontakt getreten sind?

SCENE #: | SHOT #: | SHOT SIZE:

Thema 2: **Weshalb passieren diese?**
Fragen an Eli: Was sind die Hauptgründe für den Klimawandel/Klimafolgen?
Wie denkst du beeinflusst unser grosser Konsum von Tierprodukten auf die Umwelt bzw. Klimafolgen?

SCENE #: | SHOT #: | SHOT SIZE:

Thema 3: **Was können wir dagegen tun?**
Versuchst du deinen Alltag so zu gestalten, um umweltfreundlicher zu sein?
Was machst du in deinem Alltag anders seitdem du dir dessen Thema bewusst bist?
Was kannst du unseren Höhrern mitgeben
Denkst du Vegan/Vegetarisch hat einen Positiv grossen Einfluss auf die Klimafolgen? Wenn JA wieso?

SCENE #: | SHOT #: | SHOT SIZE

Thema 4: **Wie denken wir, wird die Welt in späterer Zukunft aussehen?**
Denkst du das in der Zukunft alle gezwungen werden vegan/Vegetarisch zu leben?
Ist deiner Meinung nach Elektrofahrzeugen eine mögliche Lösung für die Klimafolgen?
Kann man deiner Meinung nach noch etwas retten?
china

SCENE #: | SHOT #: | SHOT SIZE:

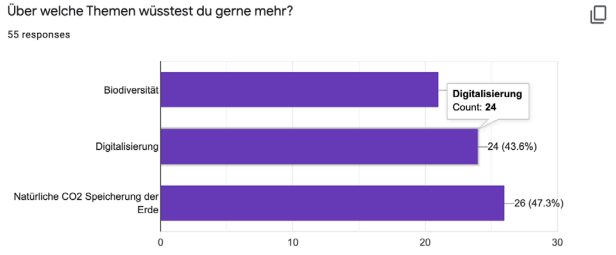
Thema 5: Eingreifen in die Natur:
Bist du mit der Situation vertraut?

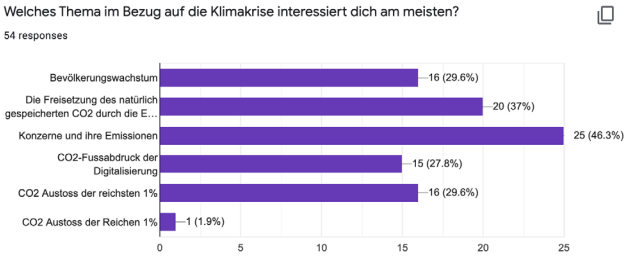
Was hälst du davon? Sollte die Menschheit jetzt auch noch in die Natur eingreifen?

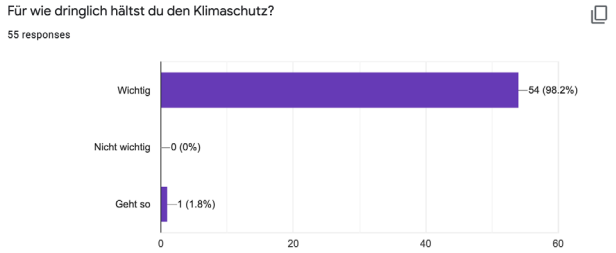
Was denkst du gibt es für mögliche Klimafolgen?

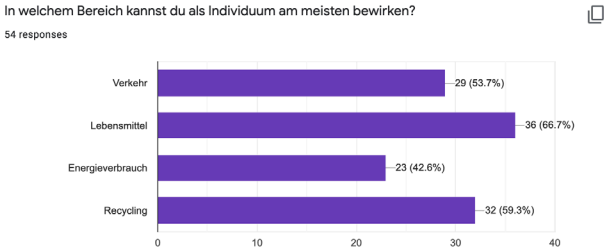
Survey

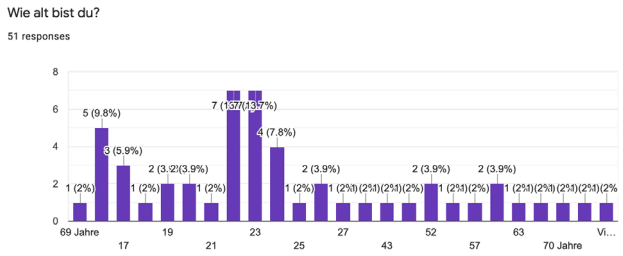
In order to find out even more precisely what exactly what the issues are that people are most concerned about or most interested in regarding the climate crisis, we conducted our own survey and again tried to identify the most prominent, as well as the lesser-known issues where there is not yet much knowledge. We also tried to find out what people think about climate change. How urgent do people think climate protection is? Can people as individuamake any difference at all?

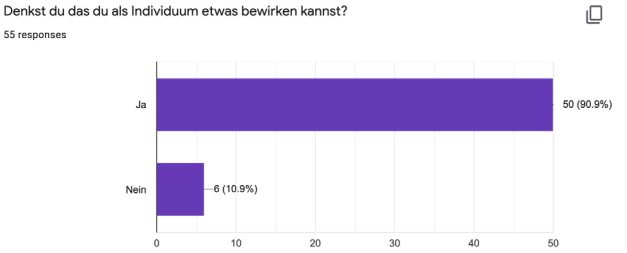




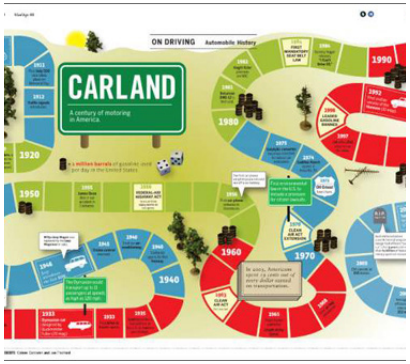


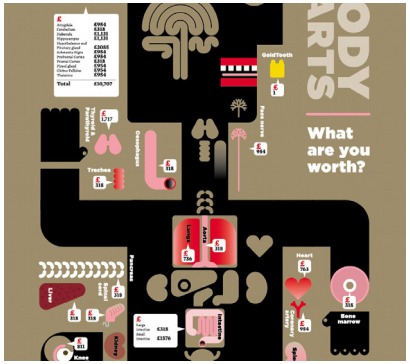


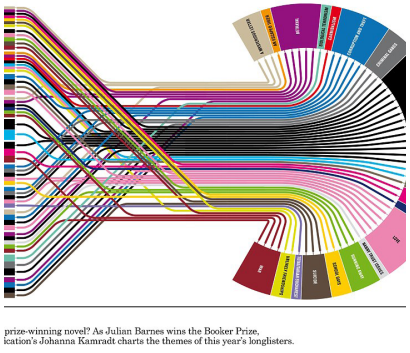


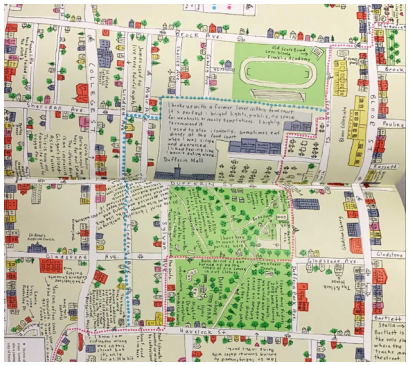


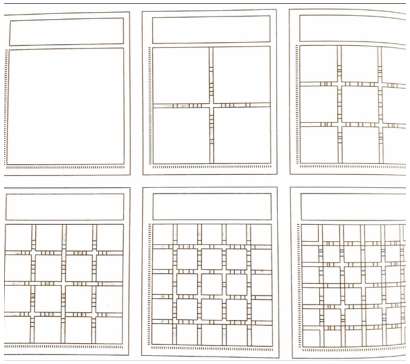
General Visual Research and Inspiration

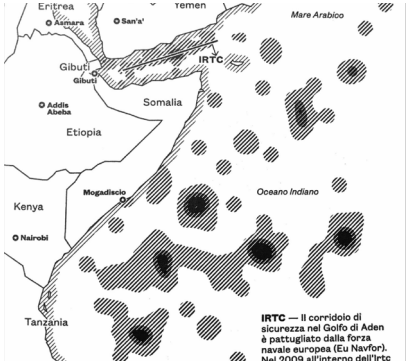


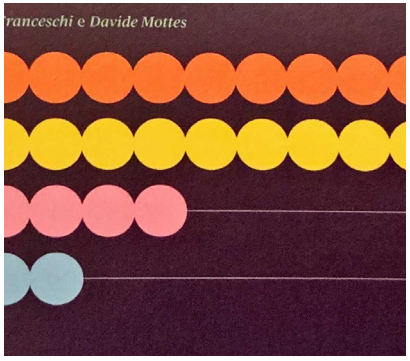


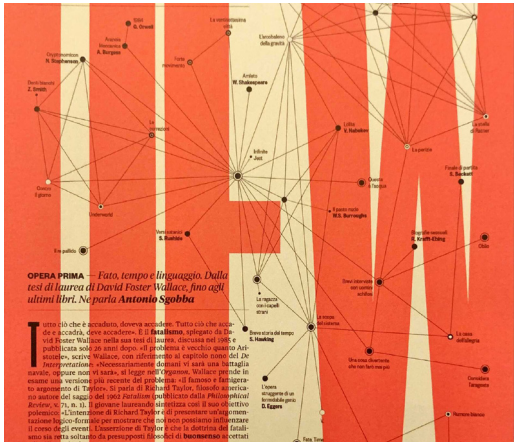


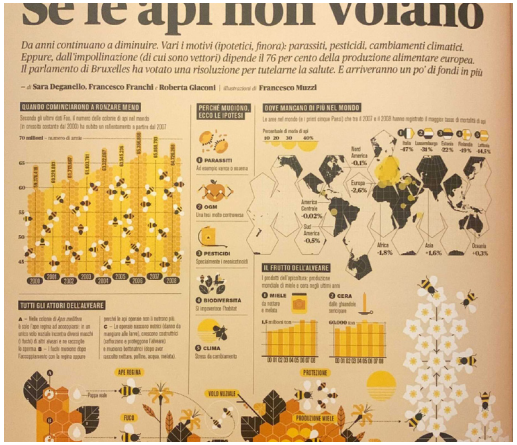


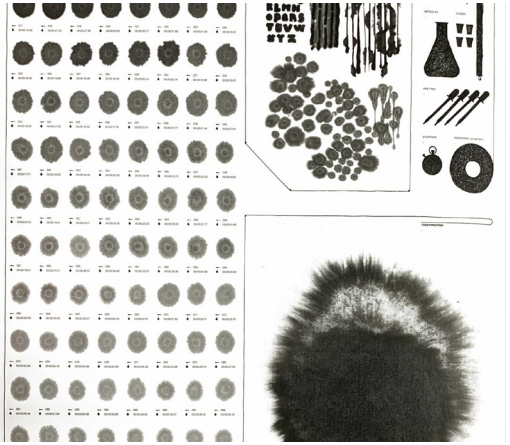


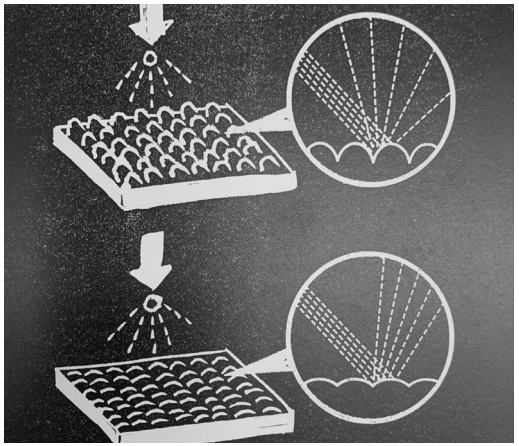


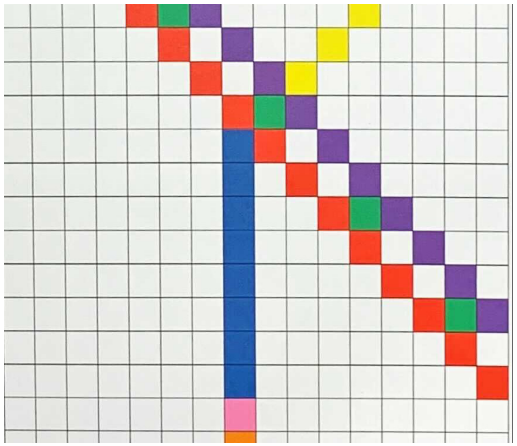


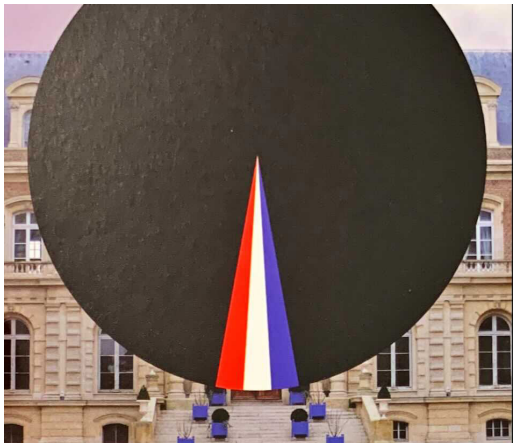


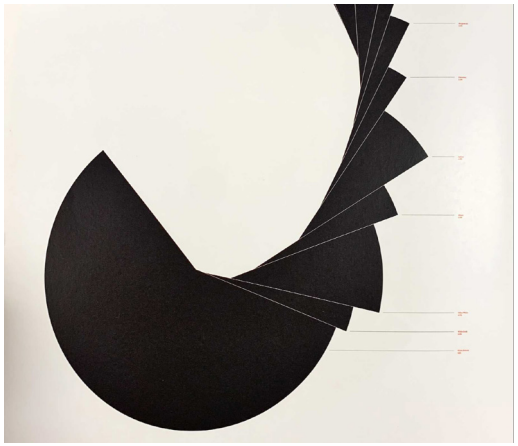


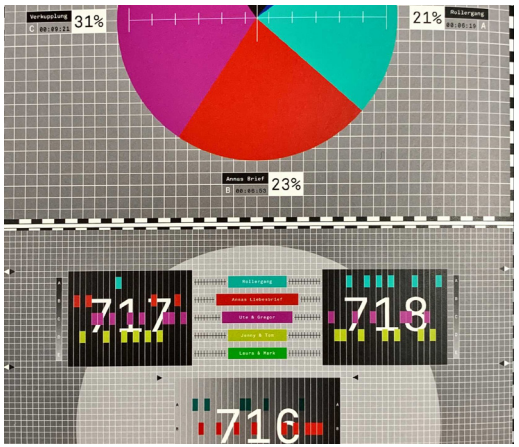


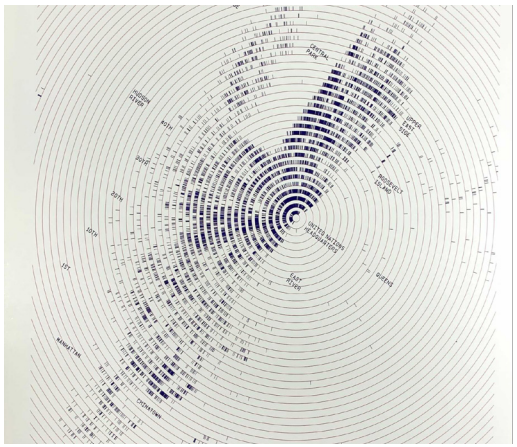


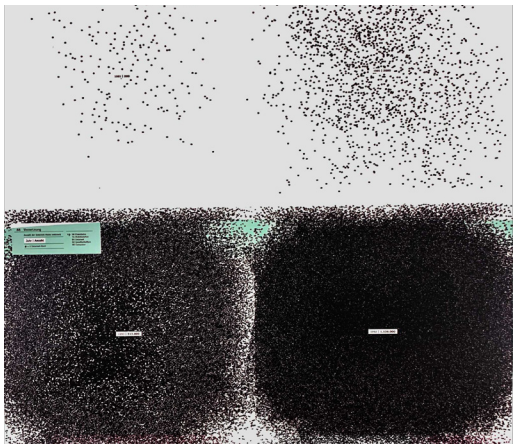


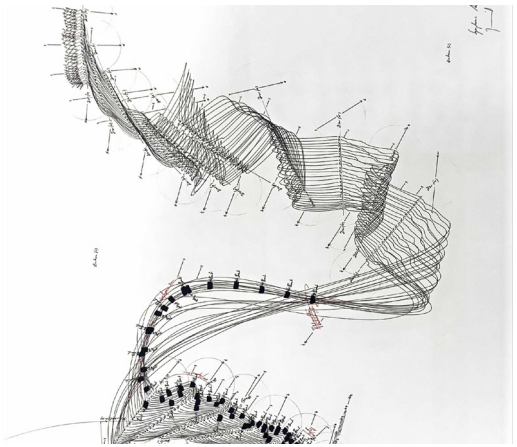












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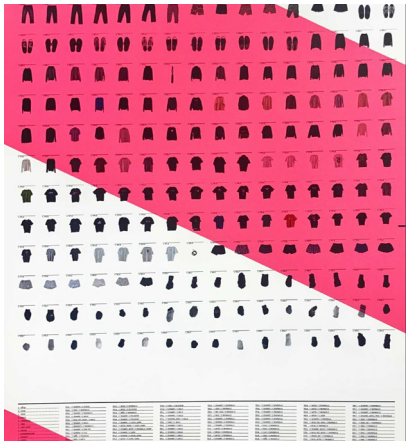

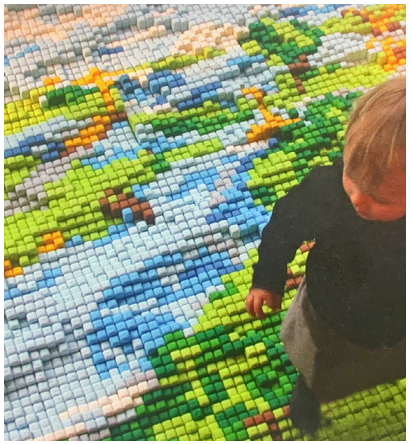
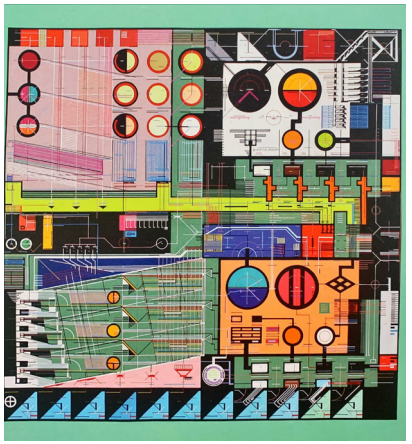
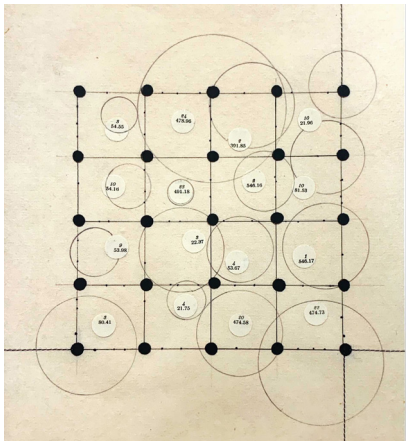
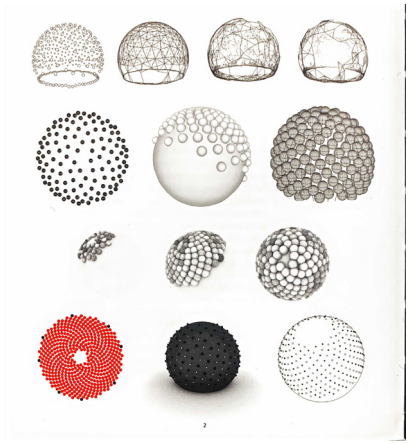
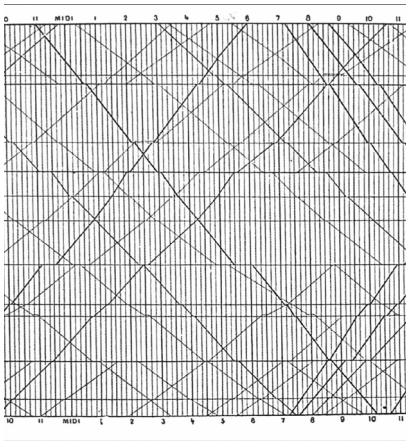
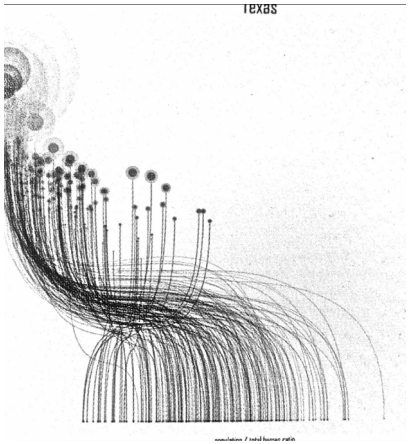

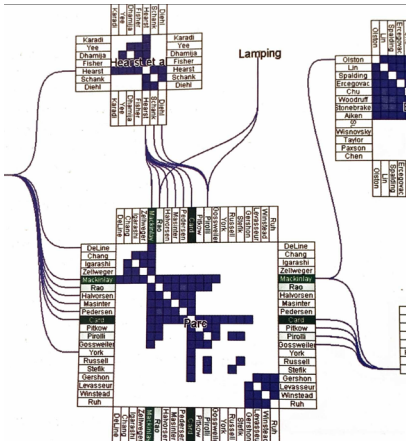

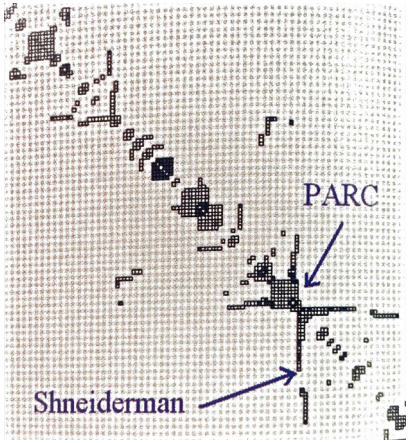

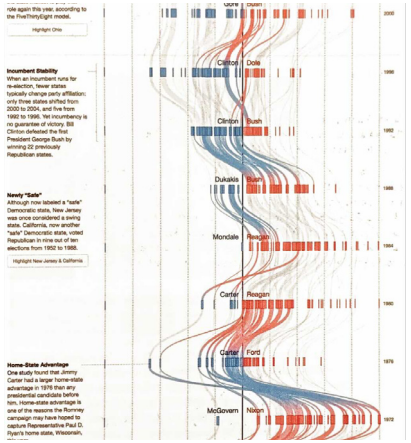
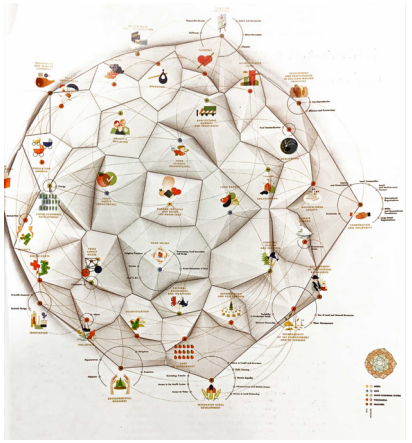
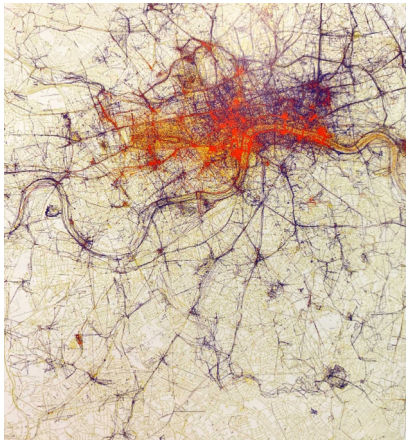
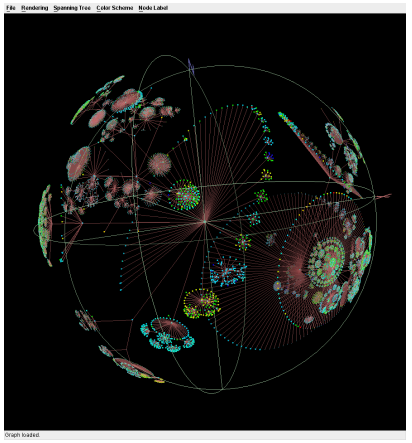

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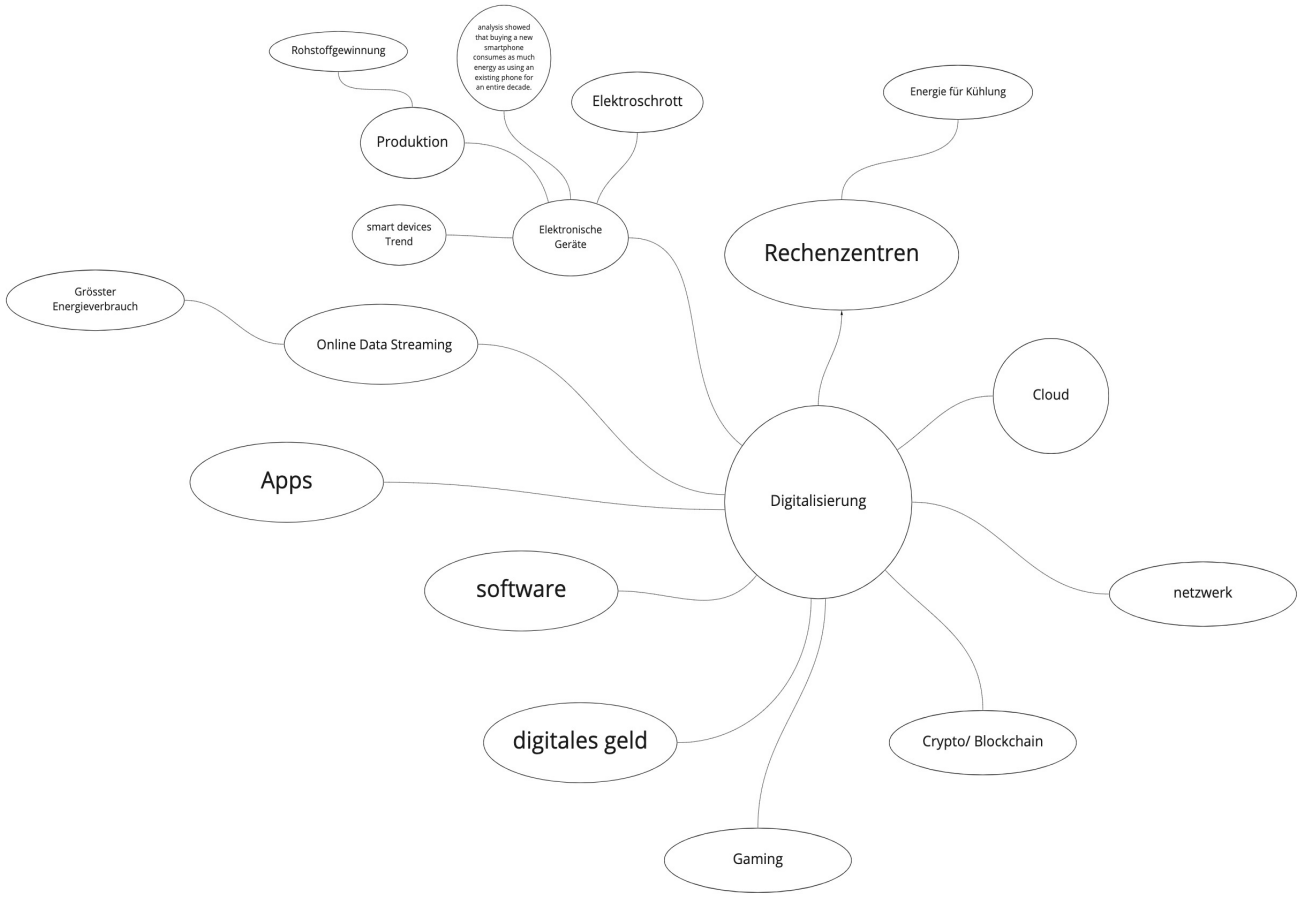
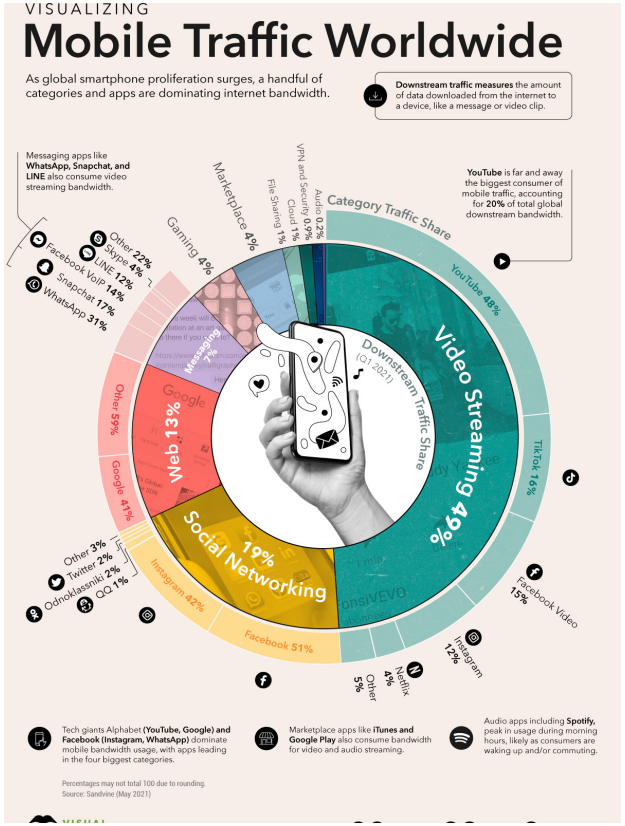
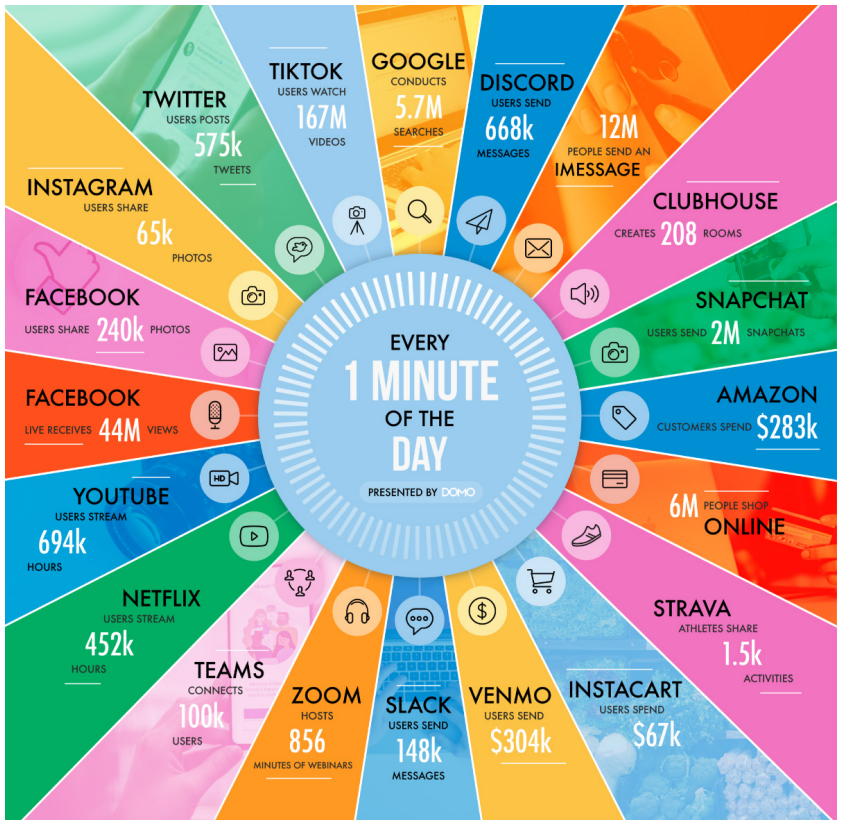
Topic Determinition and Research:

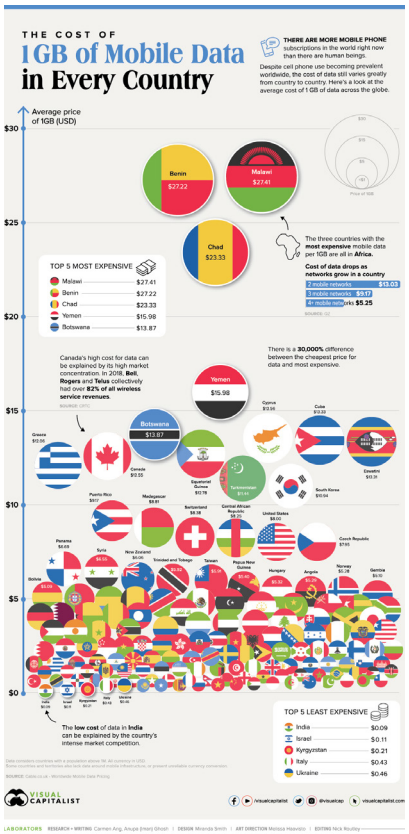
+ Co2 Emissions related to the Digitalization
= Personal Emissions through Data Traffic

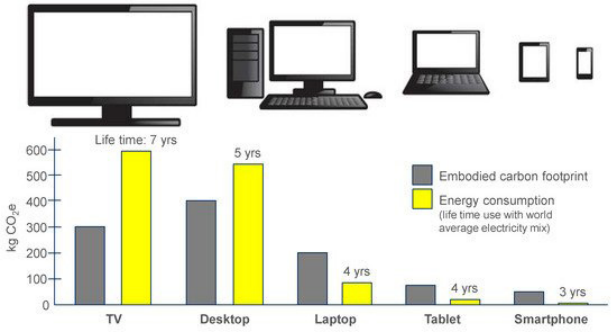
The research on our youth, the interview and our survey finally helped us to break down the many different topics into a single one. Together we decided on digitalisation and its relation to climate change. Digitalisation is a major topic, but very few people know how much energy it consumes. Many people know how energy-consuming bitcoin and blockchains are, but only few know that streaming videos or spending time on Instagram alone produces a lot of CO2 emissions through accumulation. Although today's youth is on the social networks every day and generates an incredible amount of data traffic, only a few of our respondents have seen a connection between individual mobile phone use and climate change, which is why we decided to show the individual energy consumption and the connection to the Co2 emissions. The aim was to show the personal energy consumption through applications and social networks and make it more tangible. In order to draw a connection to the Crowther lab, it was important for us to show that Co2 emissions can theoretically be compensated by trees, but that the age of the trees plays a major role in Co2 storage. We wanted to show that it makes sense to plant trees, but that it makes even more sense to preserve old trees.

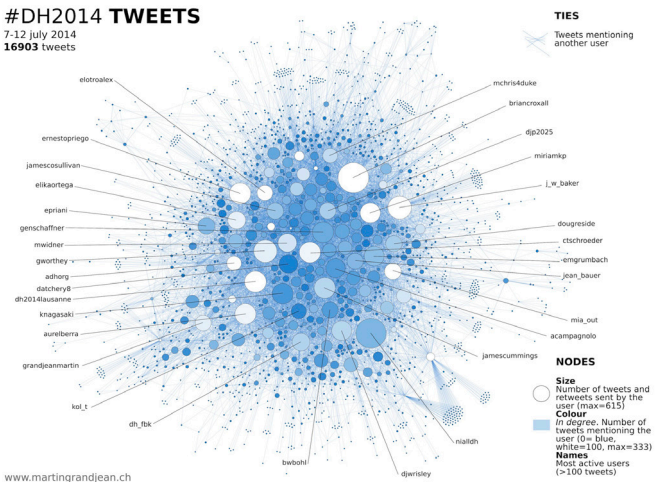



VISUALIZING
Mobile Traffic Worldwide
As global smartphone proliferation surges, a handful of categories and apps are dominating internet bandwidth.
Downstream traffic measures the amount of data downloaded from the internet to a device, like a message or video clip.
Messaging apps like WhatsApp, Snapchat, and LINE also consume video streaming bandwidth.
YouTube is far and away the biggest consumer of mobile traffic, accounting for 20% of total global downstream bandwidth.
Category Traffic Share
Downstream Traffic Share (Q1 2021)
Video Streaming 49%
Social Networking 19%
Web 13%
Other 59%
Google 41%
YouTube 48%
TikTok 16%
Facebook Video 15%
Instagram 12%
Netflix 4%
Other 5%
Facebook 51%
Instagram 42%
Other 3%
Twitter 2%
Odnoklassniki 2%
QQ 1%
Facebook VoIP 14%
Snapchat 17%
WhatsApp 31%
Other 22%
Skype 4%
LINE 12%
Gaming 4%
Marketplace 4%
Messaging 7%
File Sharing 1%
Cloud 1%
VPN and Security 0.2%
Audio 0.2%
Tech giants Alphabet (YouTube, Google) and Facebook (Instagram, WhatsApp) dominate mobile bandwidth usage, with apps leading in the four biggest categories.
Marketplace apps like iTunes and Google Play also consume bandwidth for video and audio streaming.
Audio apps including Spotify, peak in usage during morning hours, likely as consumers are waking up and/or commuting.
Percentages may not total 100 due to rounding.
Source: Sandvine (May 2021)


EVERY
1 MINUTE
OF THE
DAY
PRESENTED BY DOMO
TWITTER USERS POSTS 575k TWEETS
TIKTOK USERS WATCH 167M VIDEOS
GOOGLE CONDUCTS 5.7M SEARCHES
DISCORD USERS SEND 668k MESSAGES
12M PEOPLE SEND AN IMESSAGE
INSTAGRAM USERS SHARE 65k PHOTOS
CLUBHOUSE CREATES 208 ROOMS
FACEBOOK USERS SHARE 240k PHOTOS
SNAPCHAT USERS SEND 2M SNAPCHATS
FACEBOOK LIVE RECEIVES 44M VIEWS
AMAZON CUSTOMERS SPEND $283k
YOUTUBE USERS STREAM 694k HOURS
6M PEOPLE SHOP ONLINE
NETFLIX USERS STREAM 452k HOURS
STRAVA ATHLETES SHARE 1.5k ACTIVITIES
TEAMS CONNECTS 100k USERS
ZOOM HOSTS 856 MINUTES OF WEBINARS
SLACK USERS SEND 148k MESSAGES
VENMO USERS SEND $304k
INSTACART USERS SPEND $67k

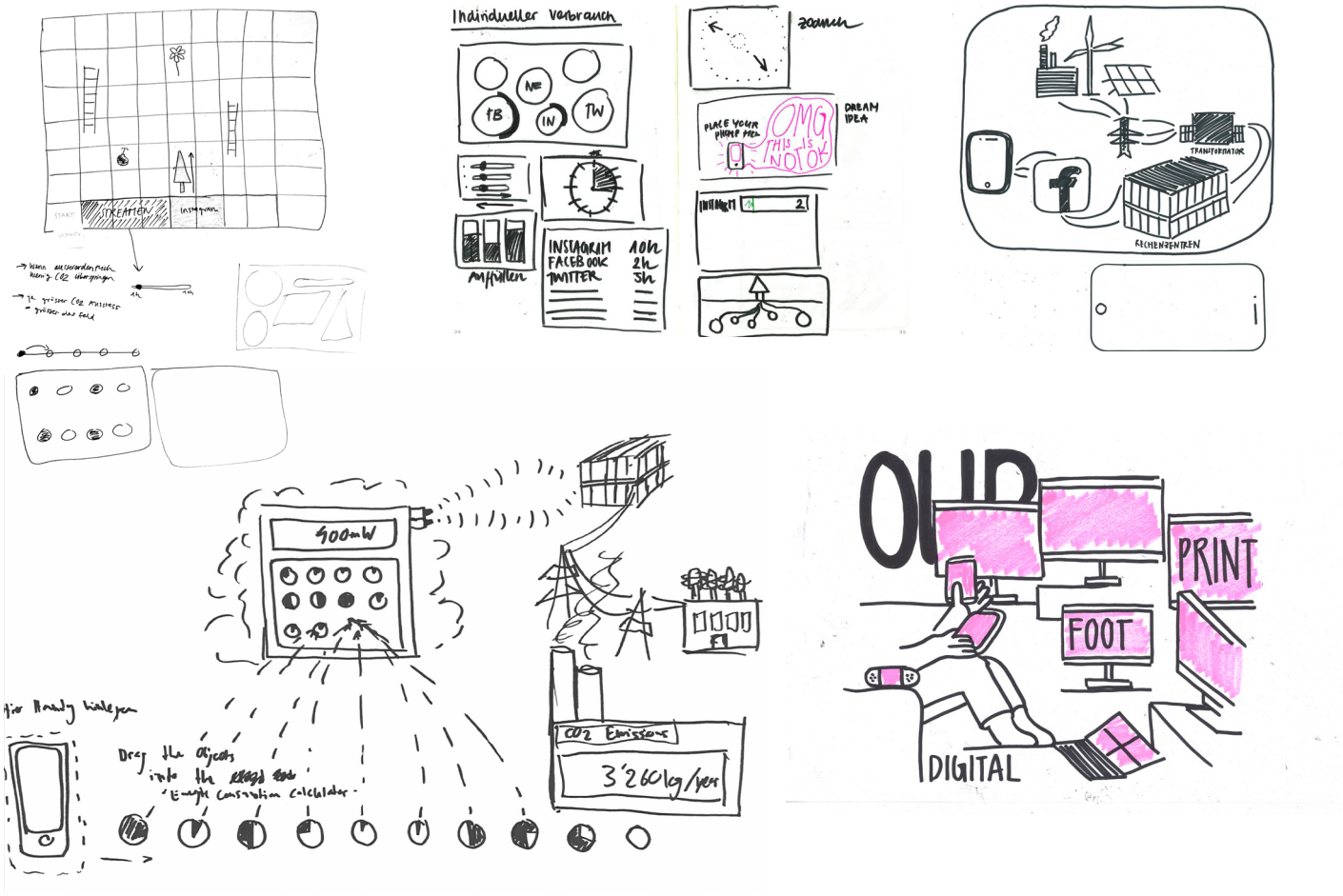

THE COST OF
1GB of Mobile Data
in Every Country
THERE ARE MORE MOBILE PHONE subscriptions in the world right now than there are human beings.
Despite cell phone use becoming prevalent worldwide, the cost of data still varies greatly from country to country. Here's a look at the average cost of 1 GB of data across the globe.
Average price of 1GB (USD)
$30
$25
$20
$15
$10
$5
$0
Benin $27.22
Malawi $27.41
Chad $23.33
Yemen $15.98
Botswana $13.87
TOP 5 MOST EXPENSIVE
The three countries with the most expensive mobile data per 1GB are all in Africa.
Cost of data drops as networks grow in a country
2 mobile networks $13.03
3 mobile networks $5.17
4+ mobile networks $5.25
Canada's high cost for data can be explained by its high market concentration. In 2018, Bell, Rogers and Telus collectively had over 82% of all wireless service revenues.
There is a 30,000% difference between the cheapest price for data and most expensive.
The low cost of data in India can be explained by the country's intense market competition.
TOP 5 LEAST EXPENSIVE
India $0.09
Israel $0.11
Kyrgyzstan $0.21
Italy $0.43
Ukraine $0.46
VISUAL CAPITALIST


Life time: 7 yrs
5 yrs
4 yrs
4 yrs
3 yrs
kg CO2e
600
500
400
300
200
100
0
Embodied carbon footprint
Energy consumption
(life time use with world average electricity mix)
TV
Desktop
Laptop
Tablet
Smartphone


#DH2014 TWEETS
7-12 july 2014
16903 tweets
TIES
Tweets mentioning another user
elotroalex
ernestopriego
jamescsullivan
elikaortega
epriani
genschaffner
mwidner
gworthey
adhorg
datchery8
dh2014lausanne
knagasaki
aurelberra
grandjeanmartin
kol_t
dh_fbk
bwbohl
djwrisley
nialldh
jamescummings
acampagnolo
mia_out
jean_bauer
emgrumbach
ctschroeder
dougreside
j_w_baker
miriamkp
djp2025
briancroxall
mchris4duke
NODES
Size
Number of tweets and retweets sent by the user (max=615)
Colour
In degree. Number of tweets mentioning the user (0= blue, white=100, max=333)
Names
Most active users (>100 tweets)
www.martingrandjean.ch

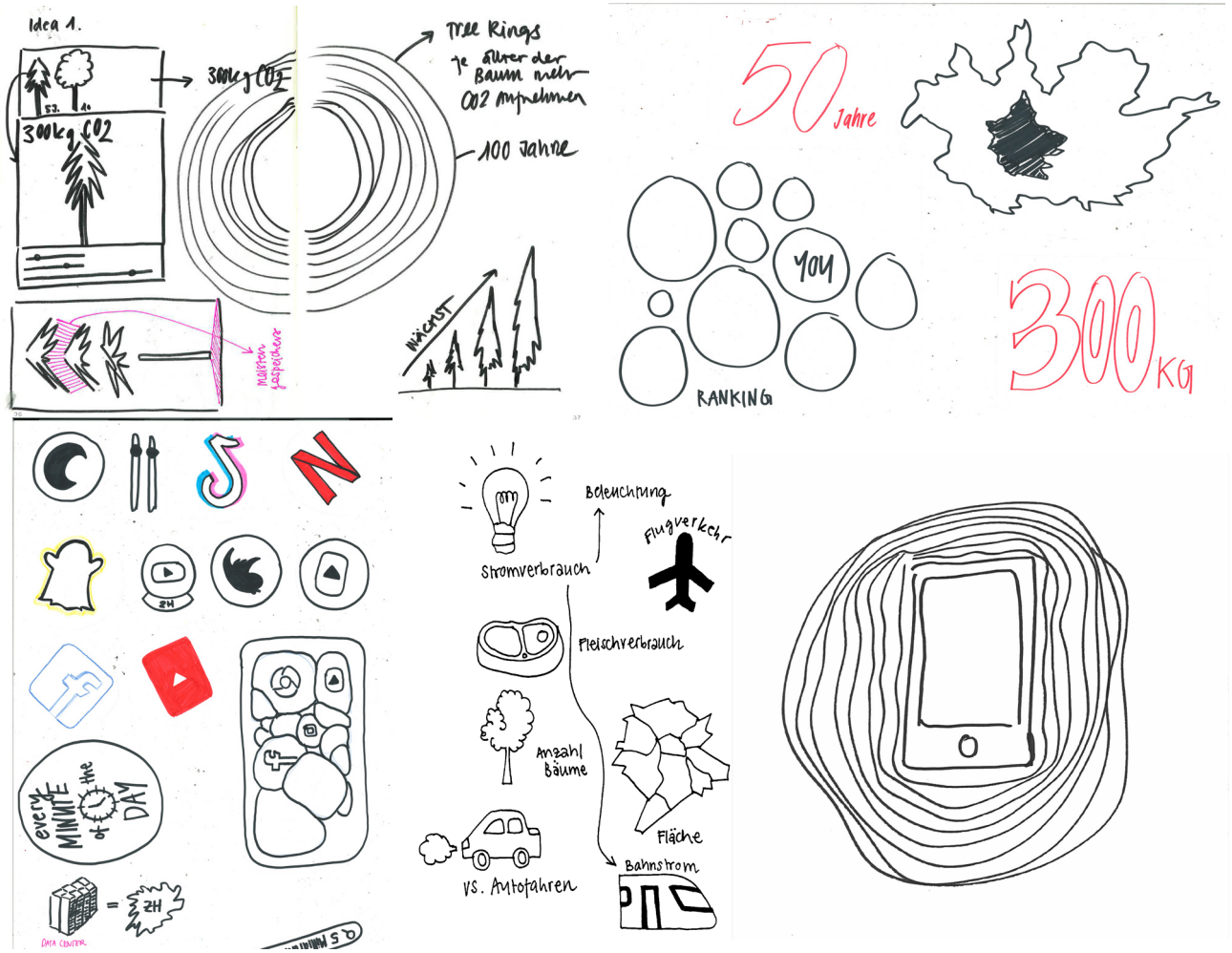
First Ideas

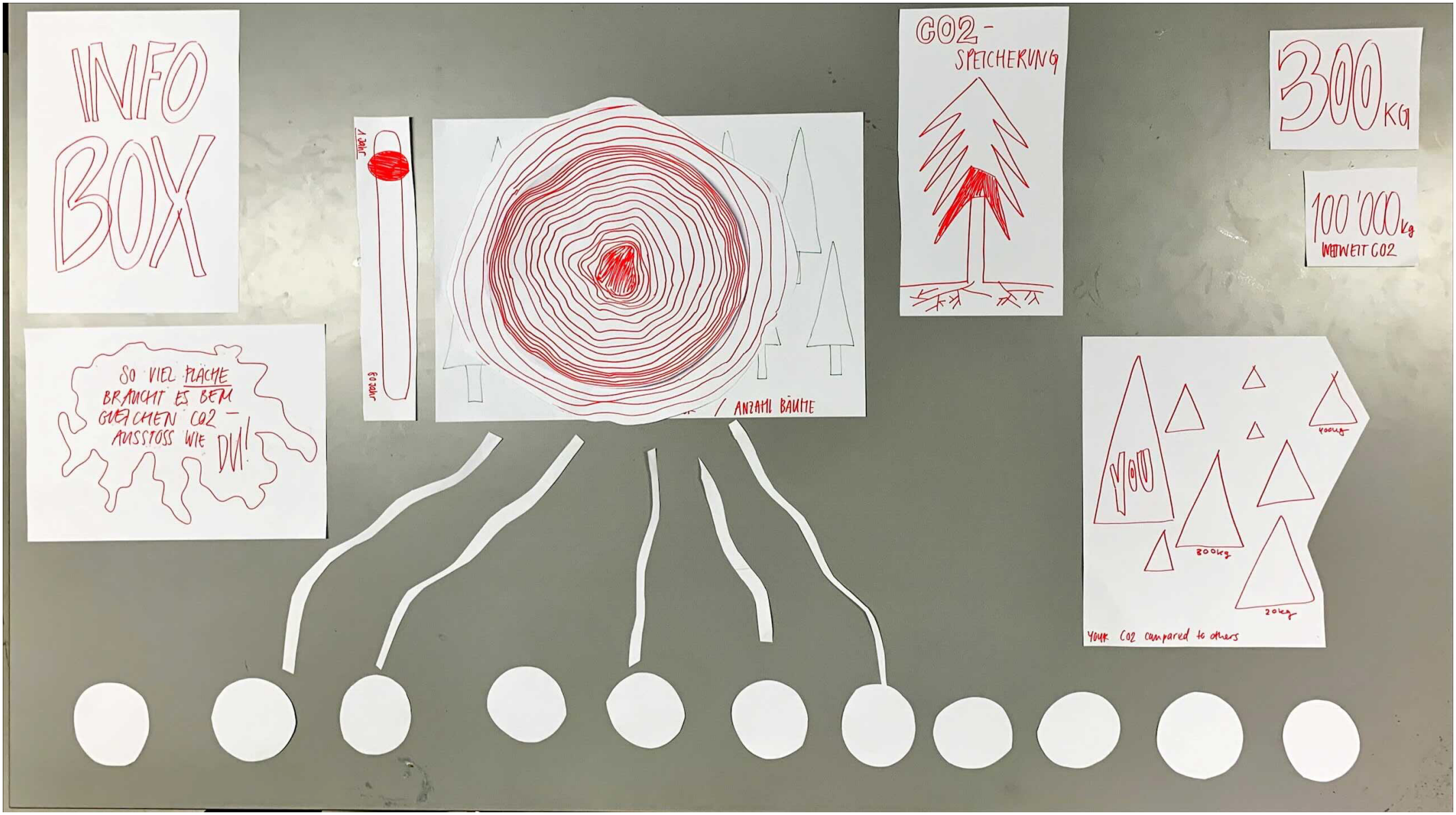
After deciding on our topic we looked at different ways to interact and display our concept.
One of our first ideas was to gameify our data visualisation, by having two users play a game with our topics included in it. But after realising that it probably would make the whole expe-rience more complicated because of the user having to learn the rules first, we quickly moved to another concept. We looked at ways to display information that doesn't overload the user and also tried to figure out how to interact with our different elements.



Paper Prototype

We decided to have the interactive part with our apps on the bottom of our visualisation to make it more accessible and easier to use. The elements to make the CO2 emissions more tangible were, the amount of trees it needs to neutralise our individual digital emissions, the age of the trees, the space it would need and a kind of ranking were users could compare their emissions to previous users. One of our ideas was to have instructions on the screen to let the users know how to access their screen time on their phones to make it easier to guess the overall time spent on the apps.




INFO
BOX
SO VIEL FLÄCHE
BRAUCHT ES BEIM
GLEICHEN CO2 -
AUSSTOSS WIE DU!
1 JAHR
60 JAHRE
ANZAHL BÄUME
CO2 -
SPEICHERUNG
300 KG
100'000 KG
WELTWEIT CO2
YOU
800kg
20kg
YOUR CO2 compared to others

Data Set

The first two weeks of this project were spent on researching and finding reliable data. It was really hard to find trustworthy datasets that relate to our topic and in the end we had to manually create our own data sets from existing studies. We found a french study of apps CO2 emissions, a study on how the age of trees relate to its CO2 absorption and for the the data on how much space a tree needs to grow we asked Thomas from the Crowther Lab, who gave us the data.

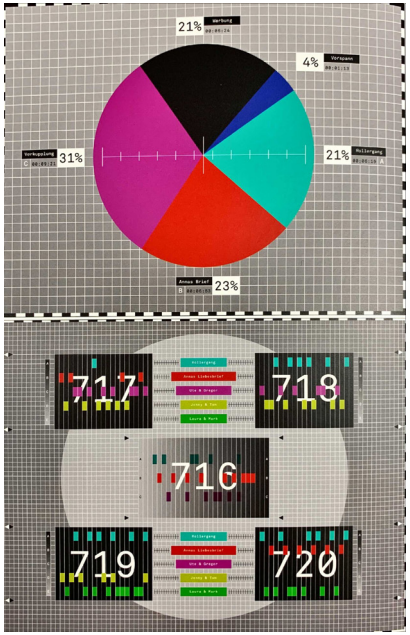
```
let DataSetMap = {
  "Tik Tok": 0.2958,
  "Reddit": 0.2724,
  "Pinterest": 0.2118,
  "Snapchat": 0.1218,
  "Instagram": 0.1146,
  "Twitch": 0.0654,
  "Netflix": 0.055,
  "Zoom": 0.050,
  "Twitter": 0.0498,
  "LinkedIn": 0.045,
  "Facebook": 0.0438,
  "Youtube": 0.0396,
  "Whatsapp": 0.01248,
  "Spotify": 0.0079
};
```

```
let TreeYears = {
  "10": 0.0453592,
  "15": 0.1587573,
  "20": 0.317515,
  "25": 0.680389,
  "30": 1.247379,
  "35": 1.81437,
  "40": 2.38136,
  "45": 3.62874,
  "50": 5.8967,
  "55": 8.16466,
  "60": 10.4326,
  "65": 12.7006,
  "70": 14.9685,
  "75": 17.2365,
  "80": 19.5045,
  "85": 21.7724,
  "90": 24.0404,
  "95": 26.3084,
  "100": 28.5763,
};
```

Programming

There were many options to choose for our framework. Our options were P5.js, d3.js and just using plain Vanilla.js. We decided to use Vanilla.js in combination with html and css. We had to manually create the data sets to be able to use the data. After having the data in our code we prioritised on having the calculations work, wich we were able to do. We basically created a fomula that recalculates the CO2 emissions as soon as someone uses the provided sliders. But unfortunately in the end we couldn‘t implement our design in the code due to a lack of time.

Moodboard for the Final Visualization



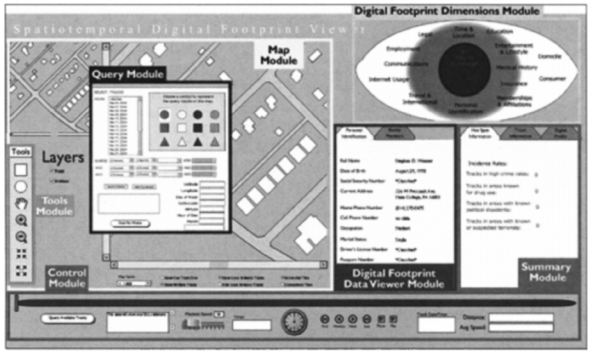
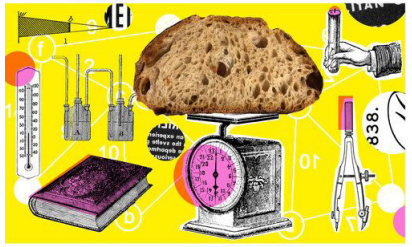
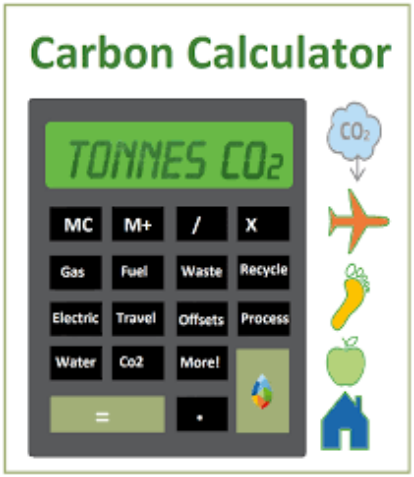


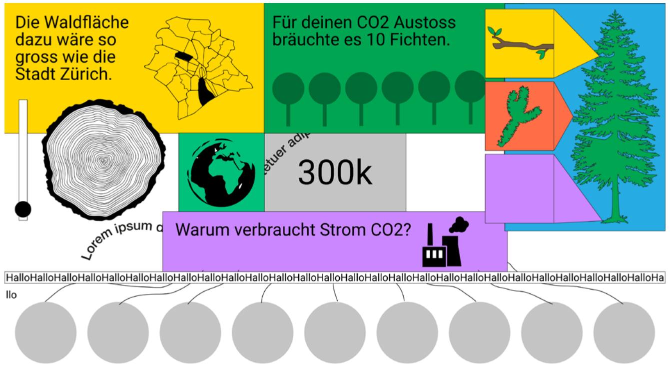
FIG. 1—As this screen capture shows, BigFoot consists of seven modules that facilitate the visualization, exploration, and analysis of a digital footprint.

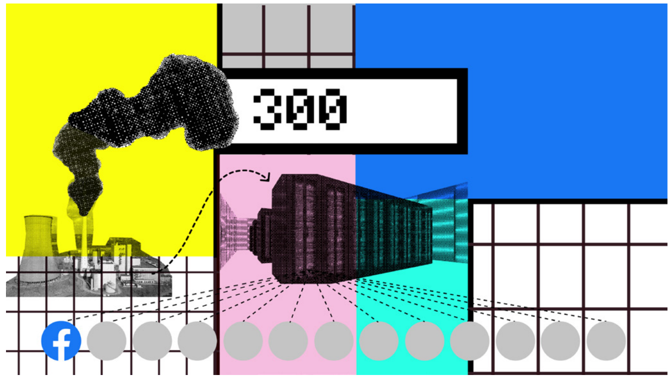


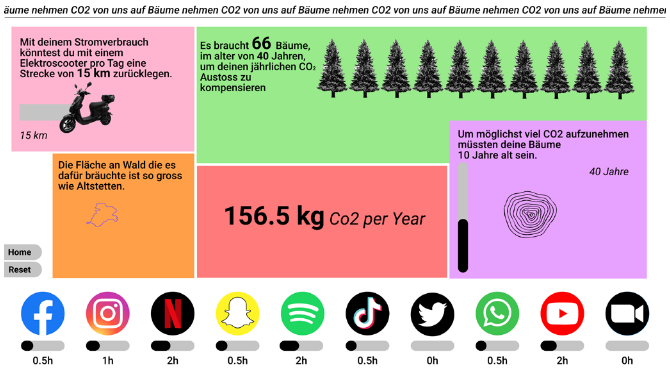


First Visual Drafts

To get a better idea on how to visualise all the elements we tried diffrent styles, colors and structure. We iterated over a couple ideas and tested them out on the screen to get a better feel on how it would look in the end. We came from two diffrent visual Drafts, which we then tried to merge together. One of our ideas was also to display the distance you could travel with an e-scooter to put the emissions in perspective.

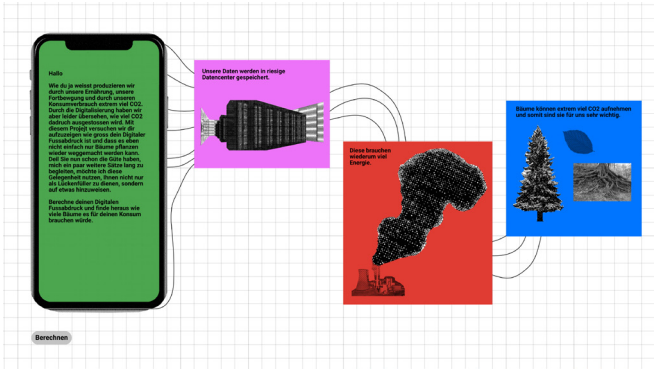


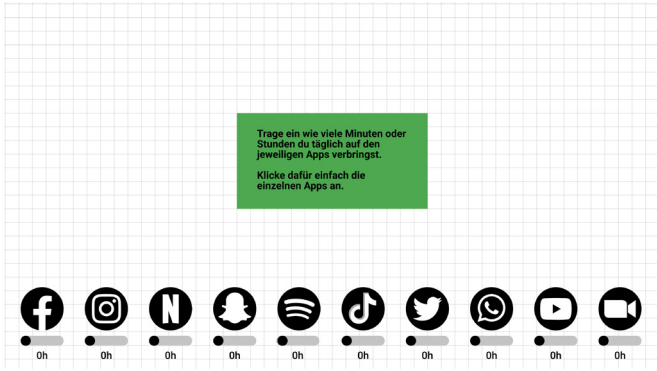


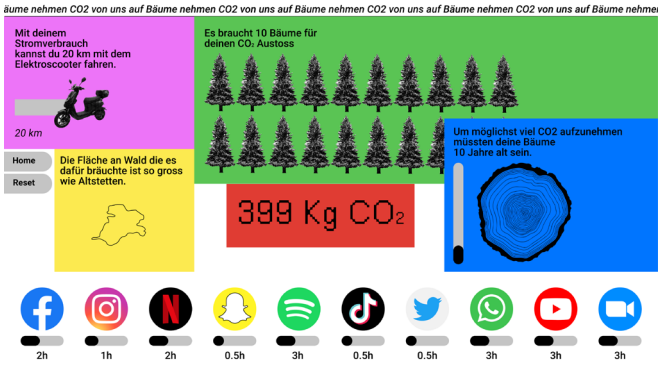


Wireframing another Approach

The first idea was to have just one screen to make everything more accessible, but the problem we faced was having all the information to our topic displayed. We also experimented with more than one screen wich gives the user a better idea on how to use our visualisation and informs the user about our topic in general

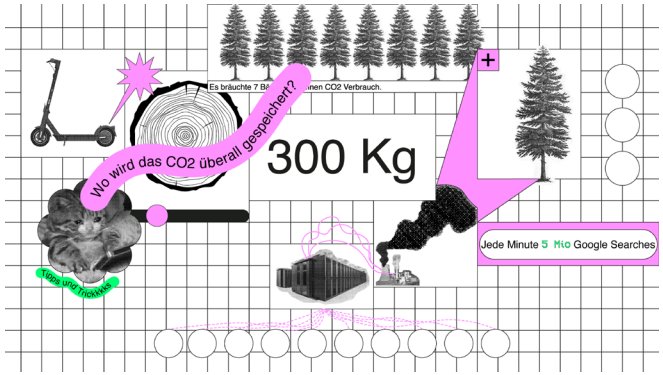


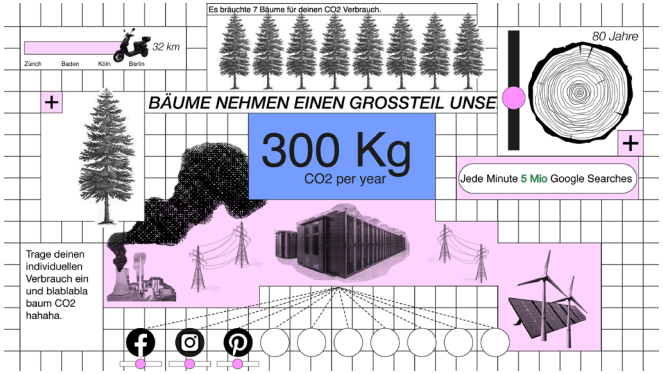


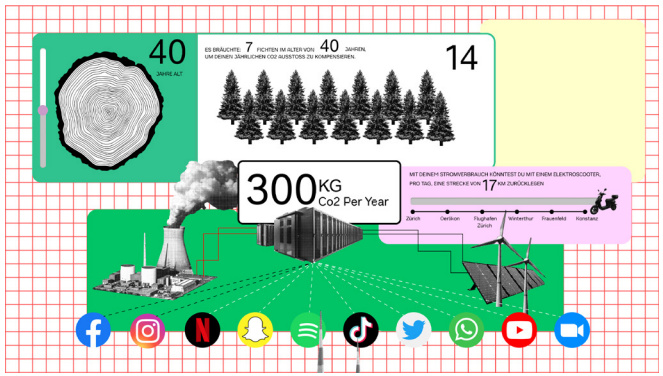


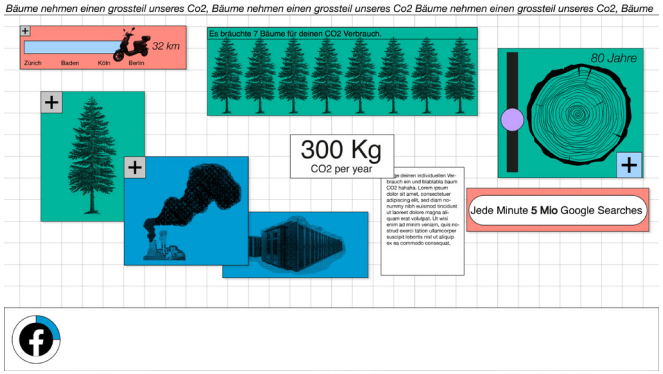
Further Attempts

In one attempt we also tried how it would be if the user could move each of the elements on the screen. So that he would be completely free in deigning the screen. His own screen. In the end, however, we rejected this idea. By experimenting more and more, we gradually arrived visually at our final screen.





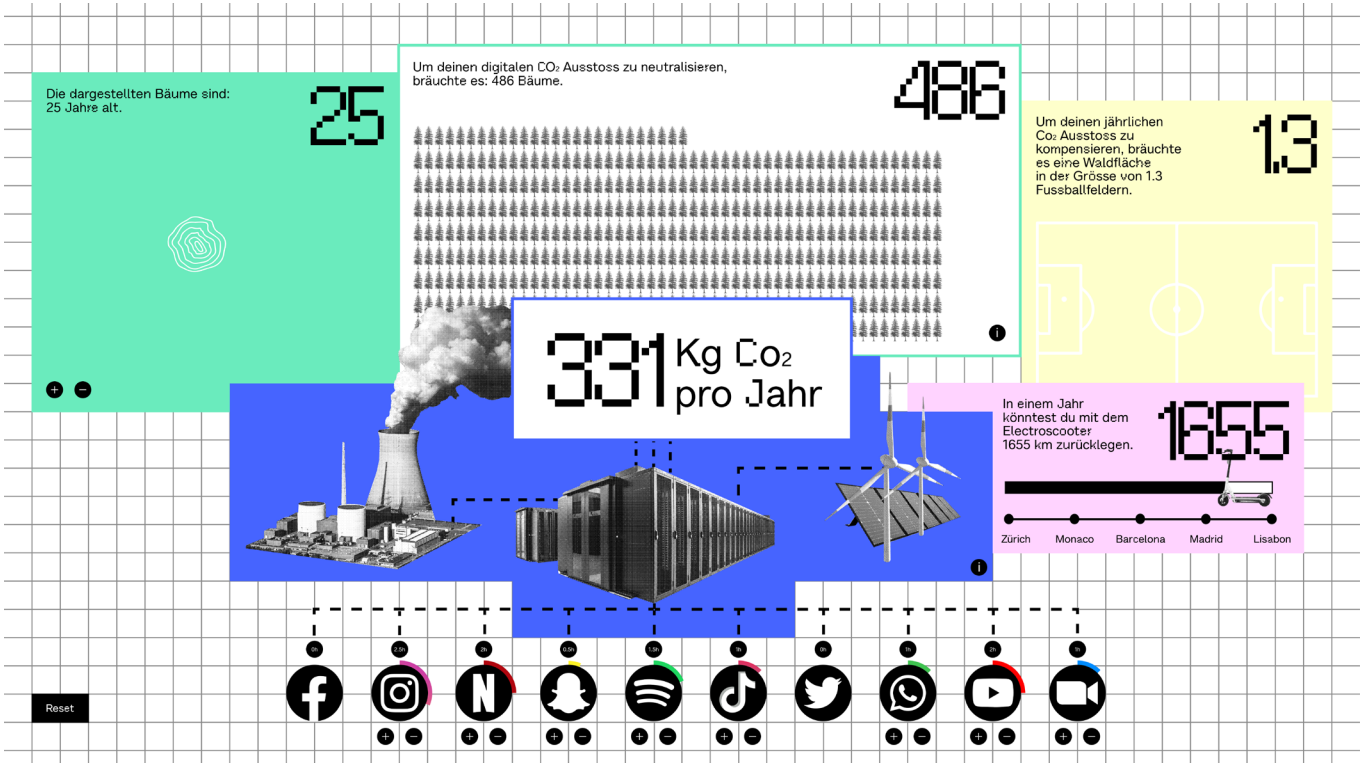


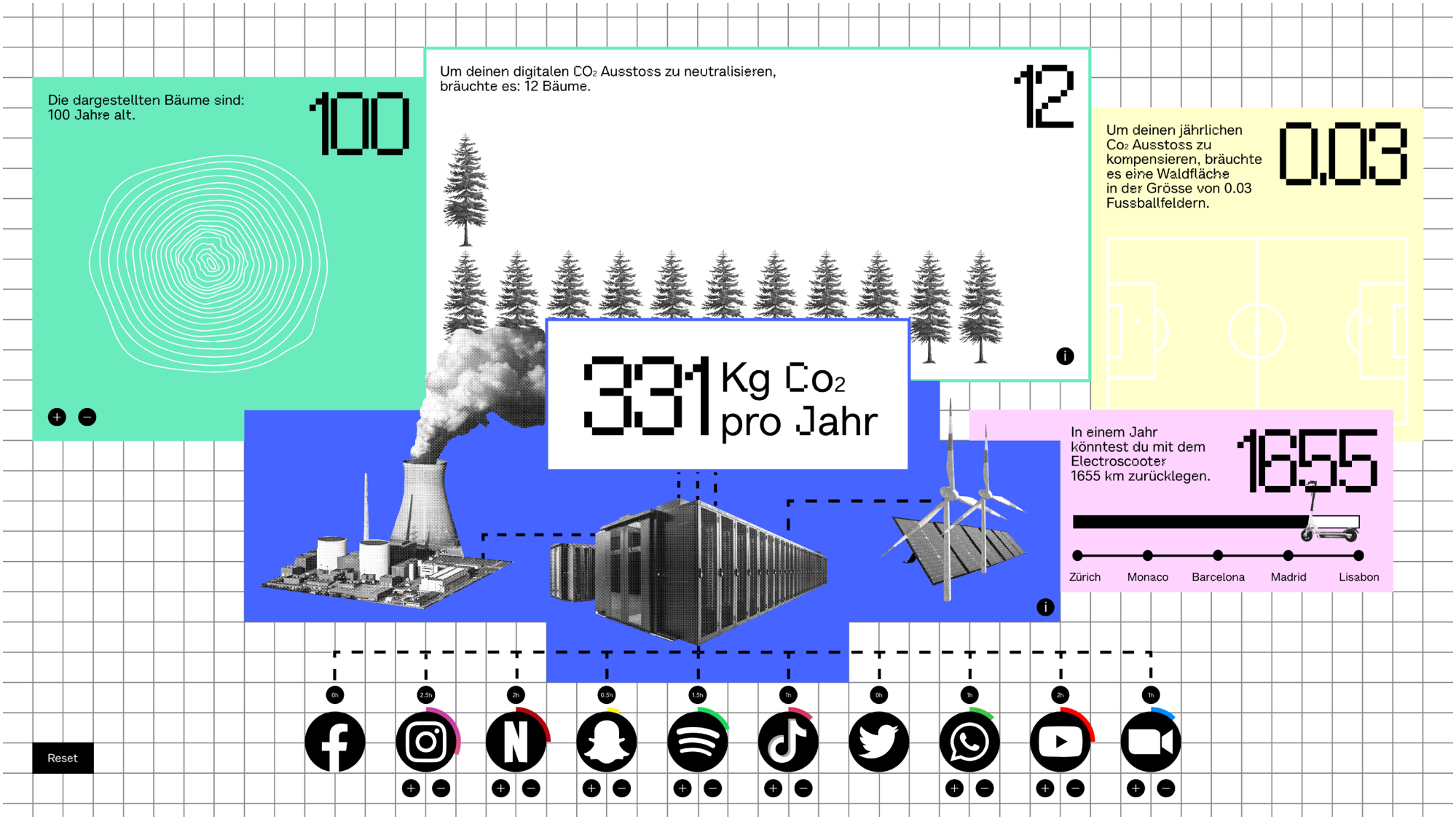


Final Screen

We finally decided on having just one screen and having additional information displayed if the user wants to know more. The elements displayed are:

Amount of CO2 emitted.
Trees needed to neutralise the digital CO2 emissions.
The amount of space those trees need to grow in comparison to football fields.
The distance that an e-scooter could travel with the same amount of CO2 emissions.
The apps where the user can input their daily consumption
The age of trees where the user can change the age and see how it affects the amount of trees needed to neutralise the CO2 emissions.




Die dargestellten Bäume sind:
100 Jahre alt.
100
Um deinen digitalen CO_2 Ausstoss zu neutralisieren,
bräuchte es: 12 Bäume.
12
Um deinen jährlichen
Co_2 Ausstoss zu
kompensieren, bräuchte
es eine Waldfläche
in der Grösse von 0.03
Fussballfeldern.
0.03
331 Kg Co_2
pro Jahr
In einem Jahr
könntest du mit dem
Electroscooter
1655 km zurücklegen.
1655
Zürich
Monaco
Barcelona
Madrid
Lisabon
Reset

Conclusion

This module was quite challenging because it covered a lot of ground. We had to research, design and code in a short amount of time. Most of the time went in to research because we really wanted to have reliable data to work with. I think we could‘ve finished the project in time if we already had some data sets ready to use. Coding was also frustrating at times but we are happy that we could manage to have the calculator work with the sliders and apps. But the most fun we had was in designing the interface. To have our design relate to our topic of digitalisation, we let us get inspired by old school digital colors and styles. In the end we learned a lot on how to delegate different things in a group. We worked good together but we also would liked some more time to finish the coding part.