Data visualization

Phones and the environment

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Theme Phones and the environment

Sub-topics Materials, Accessibility, Durability, Data centers and Sustainability

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Sub-topic: Materials

Click here to see the visualizations of this sub-topic

Visualization 1

The first visualization shows what materials are used for what parts of the phone. By showing them in an exploded view of the phone, the observer gets a better idea for what is in the phone, and this serves as a good stepping stone for the next visualization. It is a looping gif created in Adobe After Effects. Source

Visualization 2

This is an interactive visualization that shows the origin of certain materials, as well as where these materials come from. You can click the material, and the map will change accordingly. This was made using data from the dragonfly initiative and was compiled using Adobe Illustrator. Source

Visualization 3

This bar chart shows the quality of the natural resource and environmental governance of each of the countries that mines a certain material. This was also made with the data of the dragonfly initiative. Both the color and the height of the bar shows the quality of natural resource and environmental governance. This chart was created in Adobe Illustrator Source

Sub-topic: Accessibility

Click here to see the visualizations of this sub-topic

Visualization 1

The first visualization shows the mobile phone subscriptions per 100 people per country. It moves from 1991 to 2018 and shows the increase of mobile phone subscriptions throughout the years. It visualizes how mobile phones have become a vital part in people's lives with some countries even having an average of above 150 mobile phone subscriptions per 100 people. The dataset for this visualization is retrieved from:
https://data.worldbank.org/indicator/IT.CEL.SETS.P2

Visualization 2

It takes people around the world different amounts of working hours to be able to afford a phone. This visualization shows the average amount of hours a citizen of different countries has to work to be able to afford a phone of average prizes over the years. To get this visualization the average smartphone price is divided by the annual wages per person per country divided by the annual working hours per person per country. The datasets are retrieved from:

- https://www.statista.com/statistics/484583/global-average-selling-price-smartphones/
- https://stats.oecd.org/Index.aspx?DataSetCode=AV_AN_WAGE#
- https://stats.oecd.org/Index.aspx?DataSetCode=ANHRS

Visualization 3

The last visualization of this subtopic shows the correlation between the GPA per capita and the amount of mobile phone subscriptions per 100 people per country. It is possible to filter per continent. The years can also be adjusted between 1996 and 2016, 20 years apart. The correlation between GDP per capita and the amount of mobile phone subscriptions was larger in 1996 in all cases, when compared to 2016. This could mean mobile phones are becoming more of a commodity.
The datasets for this visualization are retrieved from:

- https://data.worldbank.org/indicator/IT.CEL.SETS.P2
- https://data.worldbank.org/indicator/NY.GDP.PCAP.KD?end=2018&start=1960

Sub-topic: Repairs and durability

Click here to see the visualizations of this sub-topic

Visualization 1

This visualization is meant to show that by now it has become clear through the other visualizations that phones can have a significant negative impact on the world, but that durability and lifetime of phones seems to improve. The data in this visualization seems to suggest that people are keeping the same devices longer and longer. This lengthened ownership could be caused by the increase in Price or by the increase in expected software support period as there seems to be a correlation. This correlation could however be spurious, and the lengthened lifetime could be caused by some other unknown variable. The data for this visualization came from two Statista sources on average price and average replacement cycle the software support time data was gathered from several statements from companies about smartphones and their expected software support time as well as an article from android police, only Samsung and Apple looked further into the future, this is why the data flattens out towards the end.

Visualization 2

Now that the lifetime cycle of phones is discussed the next thing to look into is what factors might decrease a phone's life cycle length. One obvious reason for people to replace their phones is a broken or cracked screen. This visualization shows how often people experience damage to their phone's screen and what the major cause of this damage is. The data came from an article on marketwatch.com.

Visualization 3

Some people might decide to switch their phone with a broken screen in for a new one, but the majority of people still opt to get it repaired instead. To visualize how much a consumer pays to get a certain part of their phone repaired as a product of its original price, this visualization was created. It shows that even when a phone is more expensive, the repairs can sometimes, even when taken relatively, still be more expensive than for a lower cost phone. The most important information that emerged from this visualization is the insanely high repair cost for an iPhone. If somehow a user would manage to break the battery and the front and back glass cover, they would almost be better off buying a new device. This data was gathered from the retailers' websites in the repairs section.

Sub-topic: Data centers

Click here to see the visualizations of this sub-topic

Visualization 1

The idea behind the first visualization is to give the viewer an overview of the number of data centers in Europe. A filled map was used where the brightness of the greyscale displays how the amount of data centers differs by country in Europe. The data was obtained from the Cloudscene platform, the world's largest cloud directory of colocation data centers and cloud service providers. The "Data Centers in Europe" page shows a list of all the European countries and the number of data centers in this country.

Visualization 2

In a traditional data center, only 17.5% of electricity generated by a power station ultimately reaches the servers. A Sankey diagram was created to visualize electricity losses. The data was obtained from the paper "Fuel Cells for Data Centers: Power Generation Inches From the Server". The values from figure 17A were used to visualize the traditional data center system losses.

Visualization 3

The paper "*Scaling up energy efficiency across the Data Center Industry: evaluating Key Drivers and Barriers*" was used to collect data from different segments of the data center market. A distinction is made between the following five segments: Small- and Medium-Sized Data Centers, Enterprise/ Corporate, Multi-Tenant Data Centers, Hyper-Scale Cloud Computing and High-Performance Computing. Gauge charts are used to show the difference of the number of servers, server power, electricity use and the average PUE. The values were obtained from the table in Appendix II of the aforementioned paper.

Sub-topic: Sustainability

Click here to see the visualizations of this sub-topic

Visualization 1

The first visualization is an overview of the waste produced by one smartphone. There are three elements, which are transportation, manufacturing and use which contribute a lot to the emission of CO2 (this amount is described in kilos per phone). By clicking on the different colors in the bar chart, you can find out more about these parts. Source

Visualization 2

In this visualization we look at how big the impact is of transportation of phones on the environment. In the visualization you can see that materials are gathered all over the world, and that they need to be shipped. This costs a lot of energy and releases CO2. But this is small compared to the rest of the process of building a phone, as explained in the second visual. Source

Visualization 3

These visualizations look at how much waste phones are responsible for. In the first, we look at how polluting phones are during their manufacturing process, in the second we look at how they pollute after use. Source

Overview of sources

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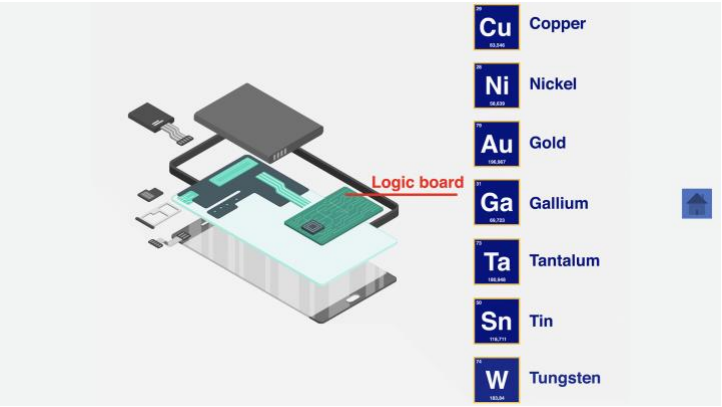
The World Bank. (2018c). Mobile cellular subscriptions (per 100 people) | Data. Retrieved from https://data.worldbank.org/indicator/IT.CEL.SETS.P2

Appendix I. Visualizations Materials

Visualization 1:



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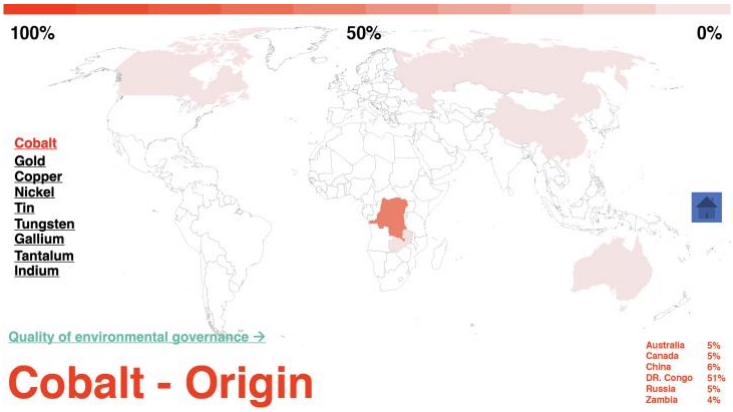

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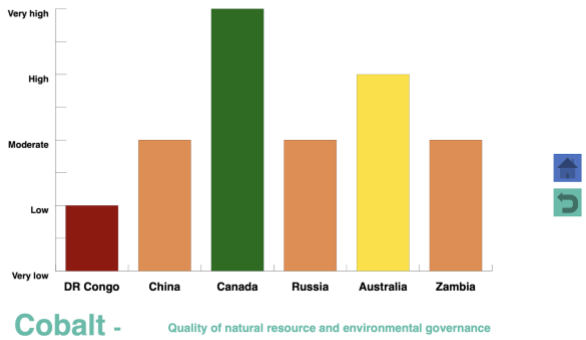
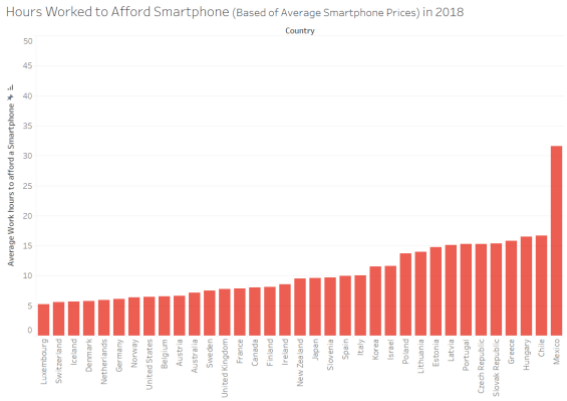
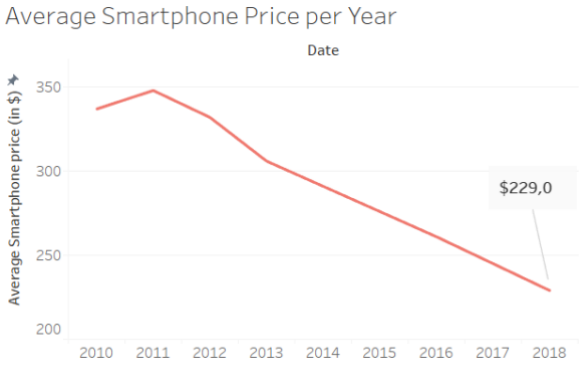


Appendix II. Visualizations Accessibility

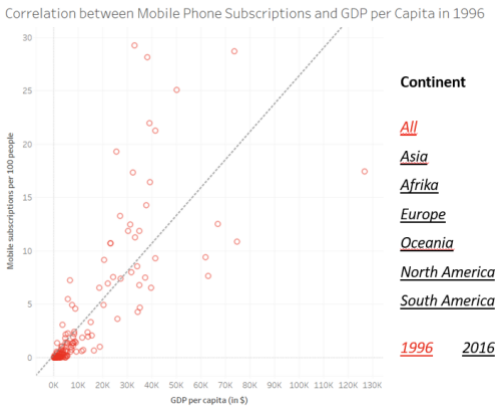
Visualization 1:

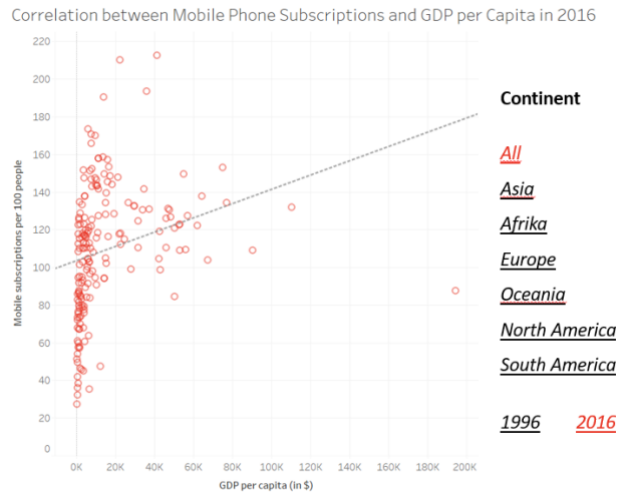
Visualization 2:





Visualization 3:





Appendix III. Visualizations Durability

Visualization 1:

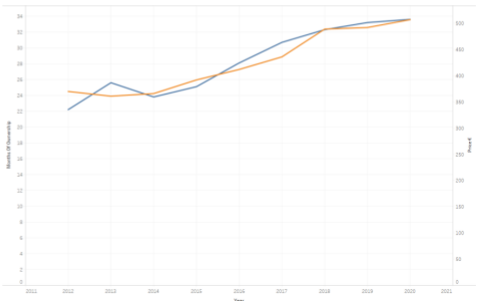
PHONE REPLACEMENT CYCLE

By now it has become obvious that phones can have a significant negative impact on the world, but things are looking up in one aspect. Data seems to suggest that people are keeping the same devices longer and longer. This lengthened ownership could be caused by the increase in Price or by the increase in expected software support period as there seems to be a correlation.

Mos. of Ownership vs. Price in Euro

Mos. of Ownership vs. Mos. of software support

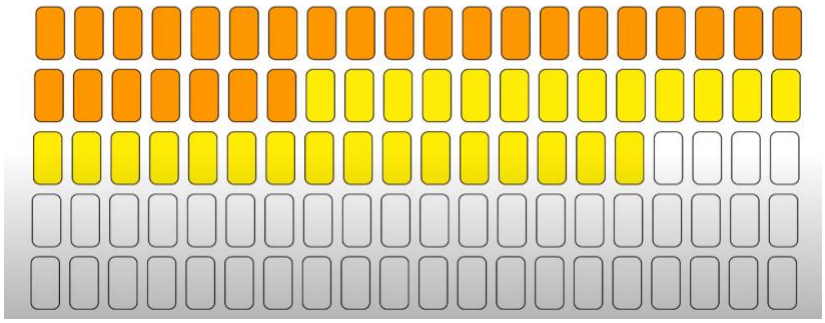
Mos. of software support vs. Price in Euro



Visualization 2:

In 2019:

27% of people only scratched their phone's screen



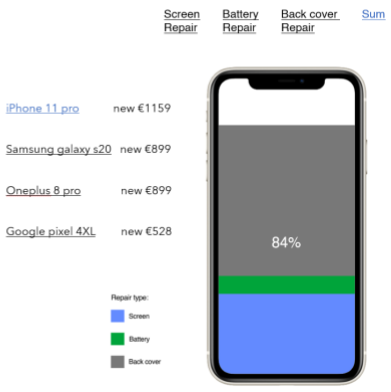
Visualization 3:

PHONE REPAIR COSTS

We learned that people tend to switch devices before their device becomes out of date software wise, but we also saw that a lot of people damage their phones.

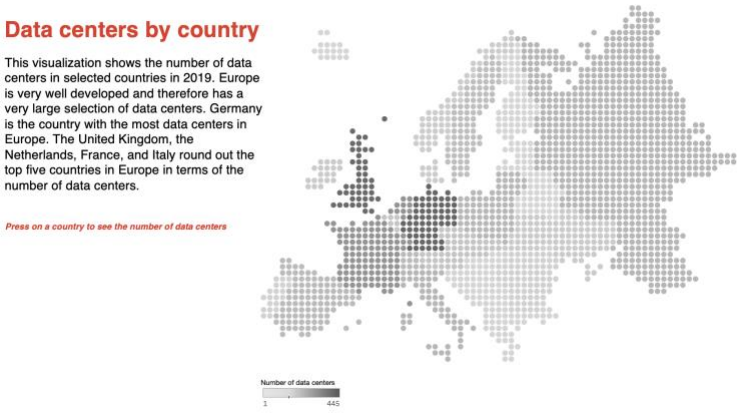
When you repair your phone screen or replace its battery when needed, the device can often last for multiple years more.

Unfortunately, it seems like most people do not take this approach and get rid of their phone before it is actually needed. This visualization shows why people might tend to upgrade devices instead of bringing them in for repair by comparing the price of a new device to the price of different repairs

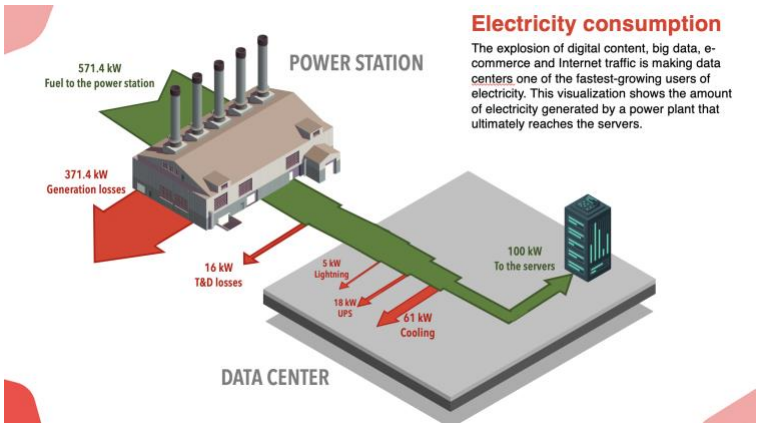


Appendix IV. Visualizations Data centers

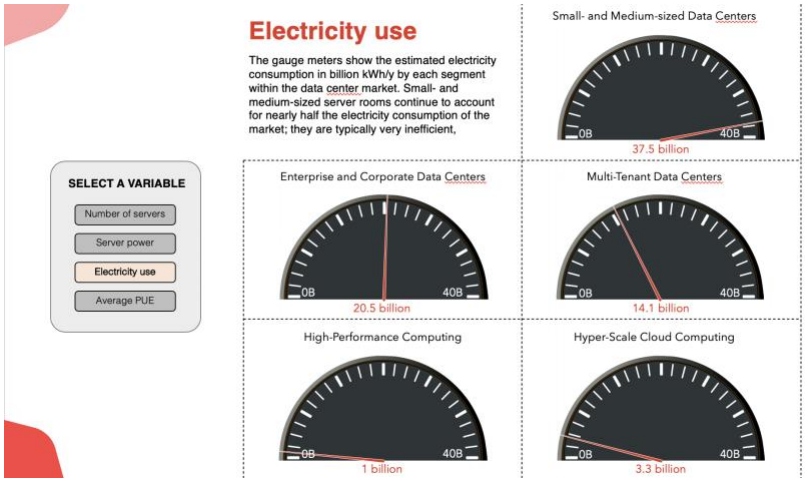
Visualization 1:



Visualization 2:



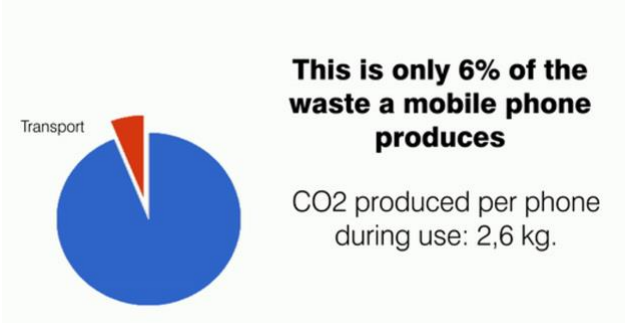
Visualization 3:



Appendix V. Visualizations Sustainability

Visualization 1:

Visualization 2:



Visualization 3: