

Final report Data Visualisation

The internet



Figure [1]

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Introduction

Theme name:	(The history of) the internet											
Proposed by:	Quirine Vafi											
Theme description:	The rise of internet has brought a lot of things together, we'd like to visualize the effects the internet has on multiple aspects of living											
Possible subtopics of the theme:	Give some possible subtopics, to recruit/lure other students: Stargaze The (internet/communication) race for speed Upcoming of internet Increasing accessibility of the internet											
Expression of interest by other students:	<table border="1"> <tr> <td>Quirine Vafi</td> <td> <i>Development of economics</i> iPhone price and quality Development of e-commerce Bankruptcies because of internet </td> </tr> <tr> <td>Rover Vos</td> <td> <i>Cryptocurrencies</i> The volatility of the bitcoin Market value cryptocurrencies Blockchain </td> </tr> <tr> <td>Patrick Wolbers</td> <td> <i>Cyber crime</i> Online piracy video game industry DDoS attacks Fraud email </td> </tr> <tr> <td>Stijn Teekens</td> <td> <i>The entertainment industry</i> The revolution of the digital music The rise of the digital video services Our ever growing usage </td> </tr> <tr> <td>Milan Boeren</td> <td> <i>Increasing accessibility of the internet</i> Global access to the internet Countries joining the internet The amount of personal computers shipped over the world </td> </tr> </table>		Quirine Vafi	<i>Development of economics</i> iPhone price and quality Development of e-commerce Bankruptcies because of internet	Rover Vos	<i>Cryptocurrencies</i> The volatility of the bitcoin Market value cryptocurrencies Blockchain	Patrick Wolbers	<i>Cyber crime</i> Online piracy video game industry DDoS attacks Fraud email	Stijn Teekens	<i>The entertainment industry</i> The revolution of the digital music The rise of the digital video services Our ever growing usage	Milan Boeren	<i>Increasing accessibility of the internet</i> Global access to the internet Countries joining the internet The amount of personal computers shipped over the world
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Milan Boeren	<i>Increasing accessibility of the internet</i> Global access to the internet Countries joining the internet The amount of personal computers shipped over the world											
Team leader:	Milan Boeren											

Data

As you can see in the table above, we choose the subject “The internet”, with a hint to the history of it. Our goal is to show what the internet has provided to society somewhere in the current and last decade. Each team member has chosen three different subtopics for this main theme, which indicates that each team member will provide a total of three different visualizations. The program we use to visualise this data is Tableau.

The theme-leader Milan will focus on the increase of accessibility of the internet, Stijn will focus on the impact of internet on the entertainment industry, Patrick will focus on cyber crime, Rover will look at the development of the internet, and lastly, Quirine will look at the participation of internet on the development of economics.

The increase of accessibility of the internet

Source data used:

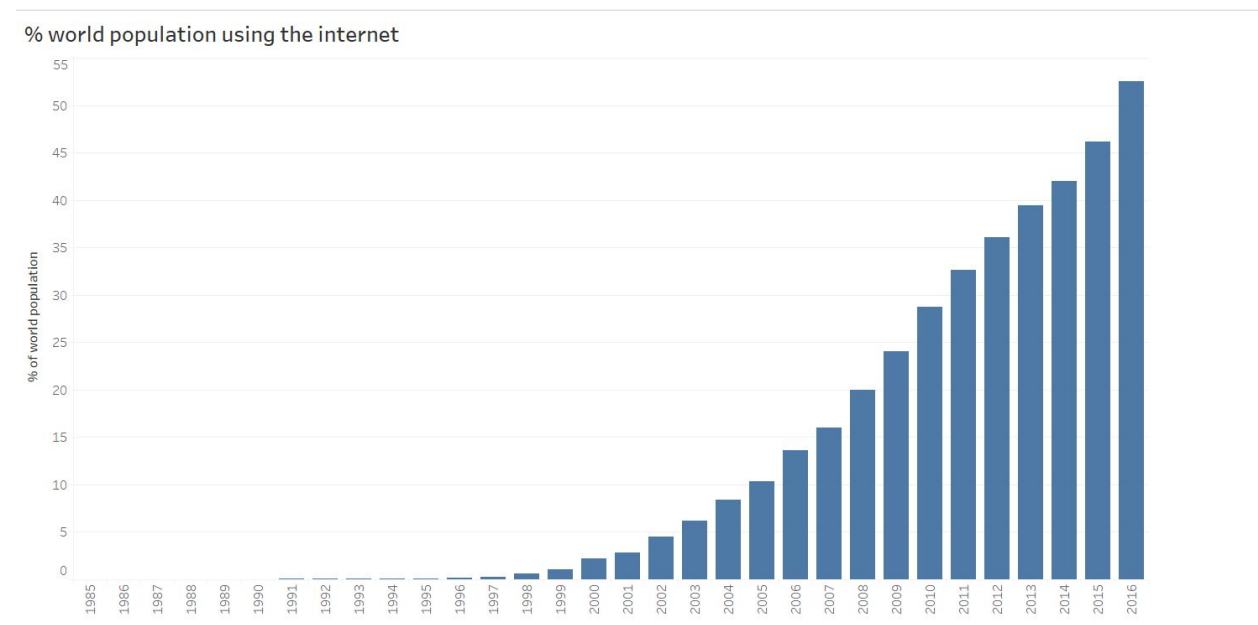
<http://api.worldbank.org/v2/en/indicator/IT.NET.USER.ZS?downloadformat=csv>

<https://data.world/lukas/when-countries-joined-the-internet>

<https://www-statista-com.ezproxy2.utwente.nl/statistics/273495/global-shipments-of-personal-computers-since-2006/>

<https://www-statista-com.ezproxy2.utwente.nl/statistics/272595/global-shipments-forecast-for-tablets-laptops-and-desktop-pcs/>

Global access to the internet

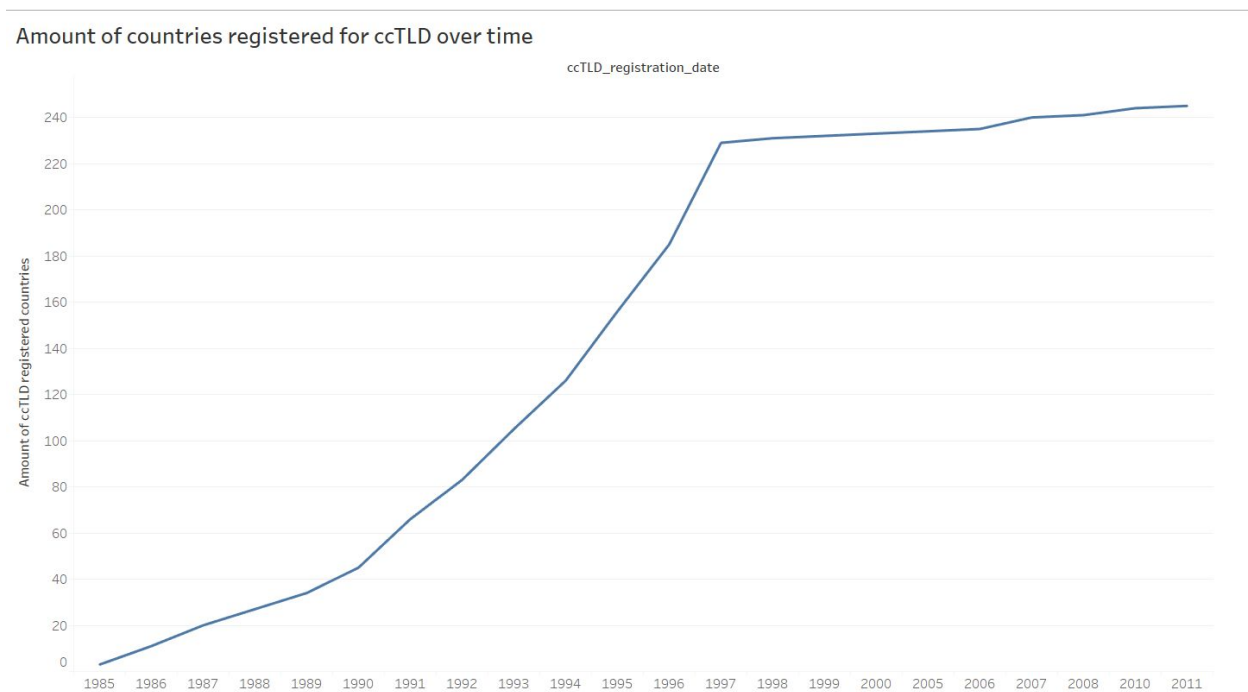
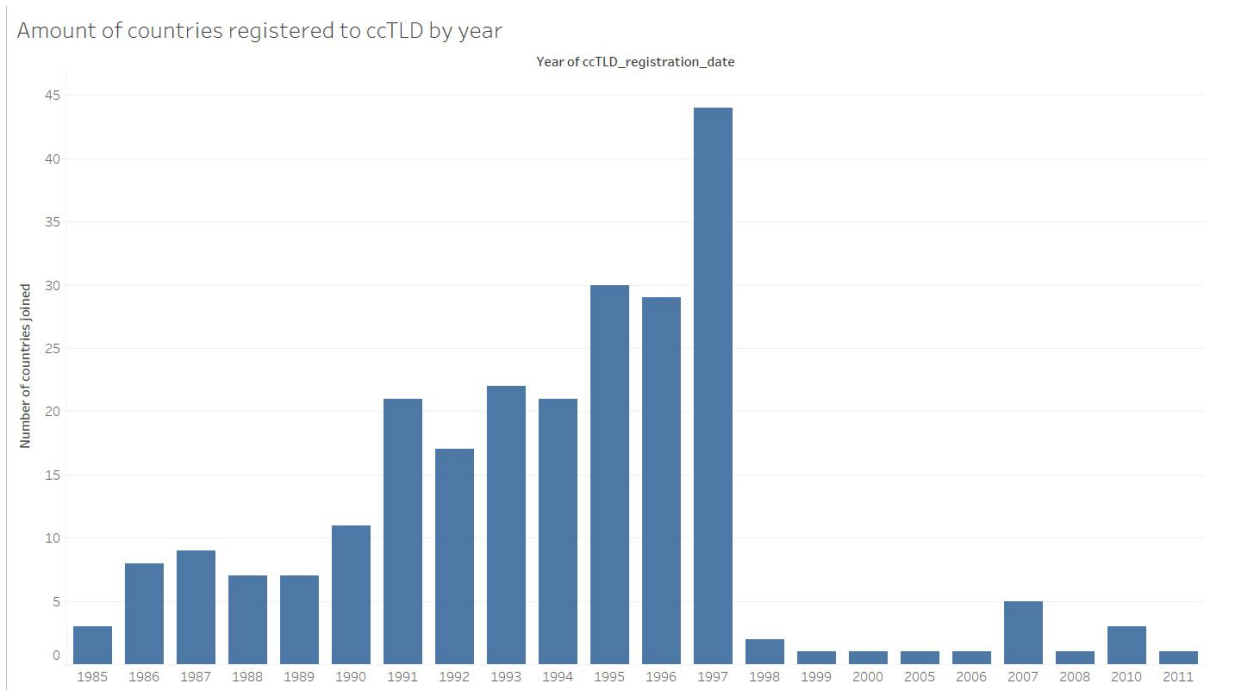


In the first visualisation I chose to use a bar graph to illustrate the growth in internet users, the graph shows the percentage of people worldwide who use the internet over time. As can be seen in the graph in more recent years like 2016 the percentage of people using the internet is 52%.

This graph fits in greatly with the main subject of the internet because it shows off the beginnings of the internet and how little people were able to use it for a long time. Only to grow in accessibility during the 2000 and eventually becoming more common to have access than not to have access to the internet.

The graph is a bar graph because of the years between 1995 and 1999 when in a line graph or area graph the changes in those early years would not be clearly visible. With bar graphs you can see a subtle difference between 1995 and 1996.

Countries joining the internet



For the second visualisation I chose to use a bar graph and a line graph to visualize the growth in ccTLD registrations over time. ccTLD stands for “country code top-level domain” . These domains are generally used for a country, sovereign state or territories identified with a country code. Examples of these ccTLDs are “.nl” for the Netherlands or “.uk” for the United Kingdom.

As can be seen the growth of the amount of ccTLD registrations kept increasing until 229 registrations in 1997. After which the amount of growth in registrations almost halted. The most likely reason for this is that almost every country has a ccTLD registration. There are a total of 195 countries in the world and in 2011 there were 245 registrations, the reason for this is the fact that there are countries registered which no longer exist, such countries are for example the Soviet Union which is registered with the “.su” ccTLD.

The data aligns with the main subject of the report because it shows the growth of countries recognizing the value of the internet and creating national domains for the use of their residents. It also depicts how in 1997 the world became saturated with ccTLDs.

I used a bar graph in the first visualisation so it would better depict the relation of the absolute number of the growth in domains. In the second visualisation I used a line graph so it would depict more a growing line, which is more pleasing to the eye.

I couldn't find any existing work depicting the growth of the ccTLDs, the closest I could find was graphs depicting the countries and the ccTLD names, as can be seen to the right.

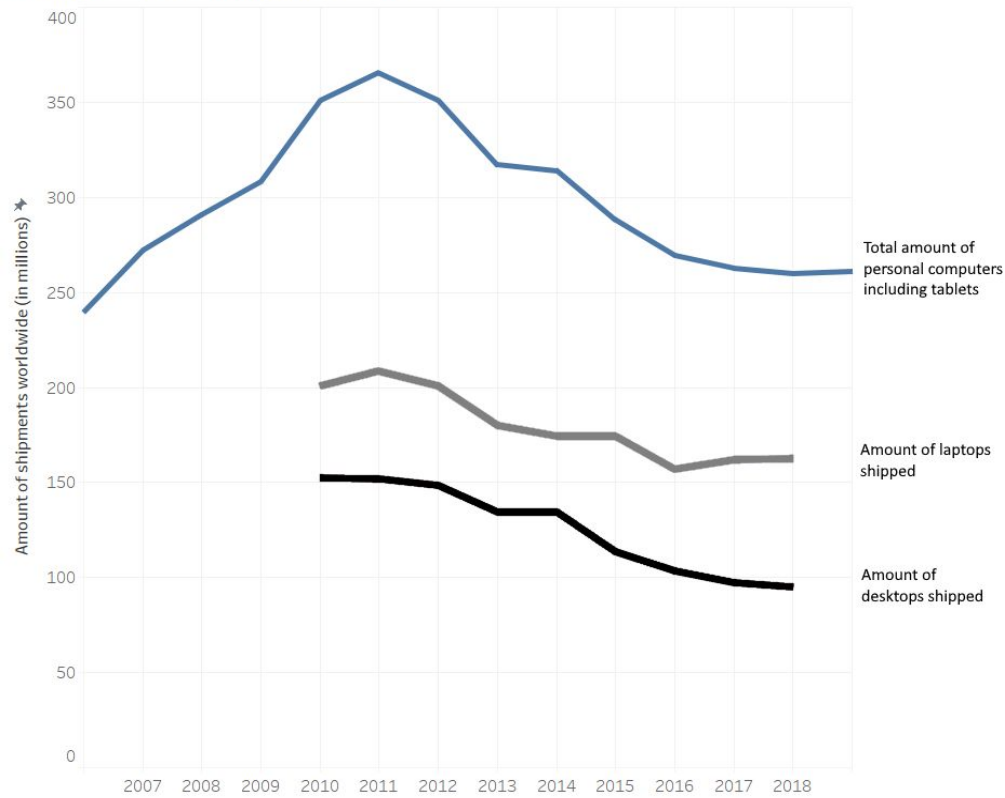


Source of the illustration:

<https://www.ionos.com/digitalguide/domains/domain-extensions/cctlds-all-you-need-to-know-about-country-code-domains/>

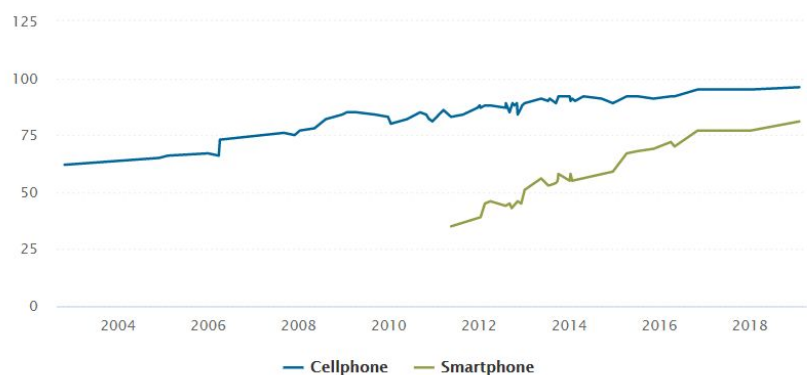
The amount of personal computers shipped over the world

Global PC unit shipments 2006-2019



In my third visualisation I used a line graph to depict the worldwide shipments of personal computers (pc's) in millions. What is interesting is that the amount of computers shipped over the world isn't an increasing graph, rather after 2011 the global shipments start to decline after 2011.

This graph shows how the main way of accessing the internet (the personal computer) rises in popularity and the drop in shipments after 2011. This could be caused by the rise in popularity of smartphones decreasing the need for access through pc's as can be seen in the graph on the right, it depicts the percentage of the population of the United states who owns a smartphone, as you can see from 2011 onward the popularity only rises. Source:



Source: Surveys conducted 2002-2019.

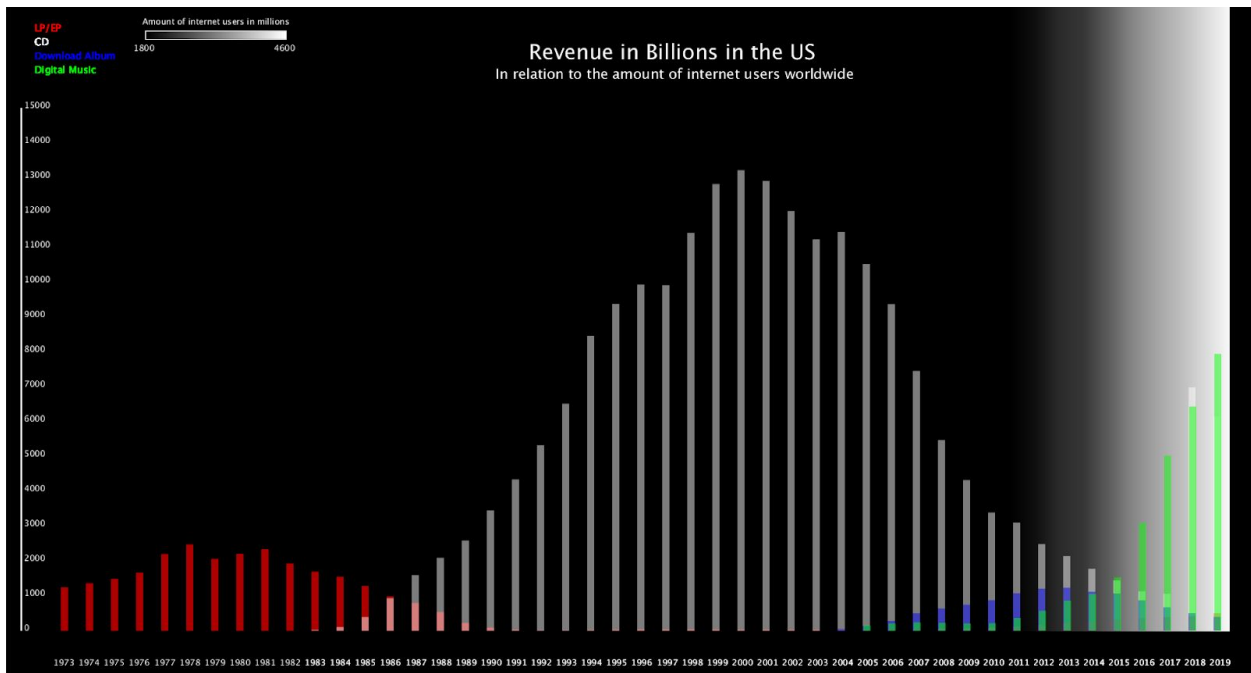
<https://www.pewresearch.org/internet/fact-sheet/mobile/>

This time I chose to use a line graph to depict the amount of shipments, even though it is an absolute number and in the previous graph it is stated that bar graphs are better to depict those in the situation. This graph is an exception, the numbers are so great that a bar graph wouldn't heighten the accuracy of the depiction. Instead the choice was made to use a line graph to show the flow of the shipments more.

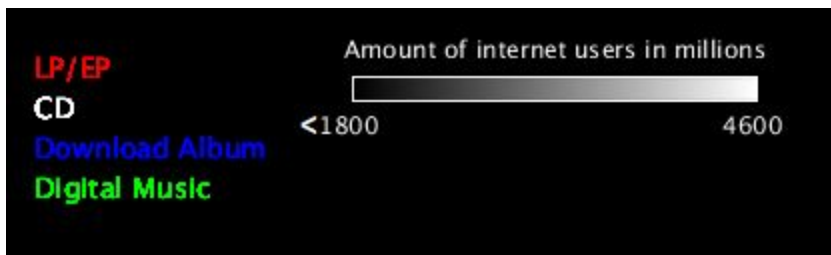
The impact of internet on the entertainment industry

- Source data used: <https://www.riaa.com/u-s-sales-database/> 1
<https://adstudio.spotify.com/meet-your-audience> 3
<https://www.statista.com/statistics/244995/number-of-paying-spotify-subscribers/> 3
<https://www.statista.com/statistics/367739/spotify-global-mau/> 3
<https://www.businessofapps.com/data/spotify-statistics/> 3
<https://www.statista.com/statistics/660920/number-of-netflix-subscribers-in-the-netherlands/> 3
http://echelonstudios.us/?page_id=681 2
<https://mashable.com/2015/01/04/tv-media-tech-ces/?europe=true> 2
<https://www.statista.com/statistics/188634/number-of-us-drive-in-cinema-sites-since-1995/> 2
<https://www.statista.com/statistics/188624/number-of-us-indoor-cinema-sites-since-1995/> 2
<https://www.statista.com/statistics/265147/number-of-worldwide-internet-users-by-region/> 1,2,3
<https://www.ironpaper.com/webintel/articles/video-demand-statistics-trends/> 2

The revolution of the digital music



Revenue in billions of \$ in the music industry of the U.S. in relation to the amount of internet users worldwide.

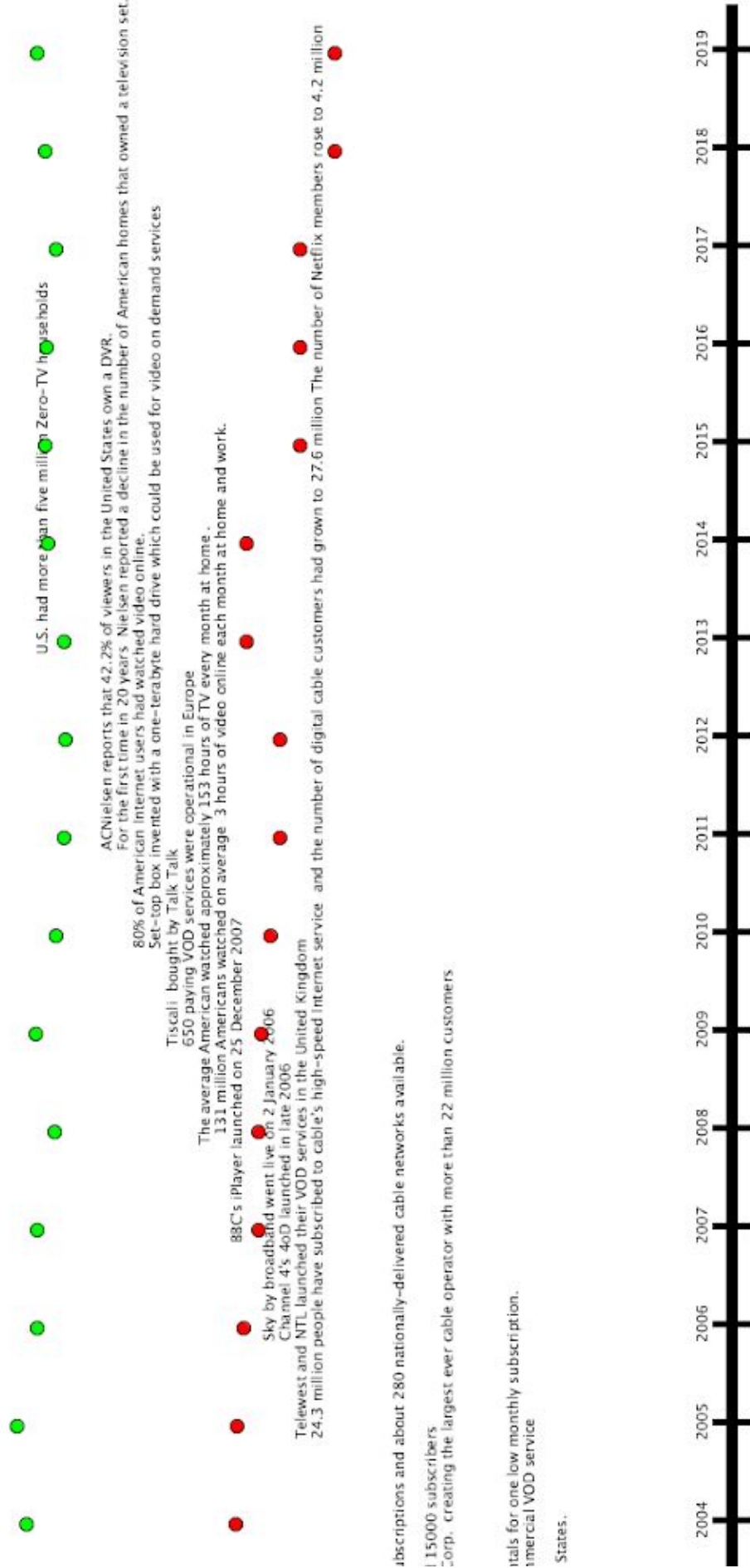


This graph made in Processing shows the revenue of 4 categories chosen from a list of salesware: LP/EP's, CD's, Albums downloaded and other forms of digital music. This graph shows 3 clear periods in time where different ways of music were widely used. First the old records up till 1985, then the CD's took the throne until somewhere around 2015 and at the end the digital sales skyrocket. Interesting is that year is also the period where the internet becomes widely used as the amount of internet users also start to grow quickly. The period in which the revenue in CD's starts to decrease is when the internet took the stage, but the amount of internet users was yet to grow enormously. I choose these colors because they are primary colors + black and white which have great distinction between each other.

The rise of the digital video services

Number of drive-in cinema sites in the U.S. Number of indoor cinema sites in the U.S.

In relation to events regarding the digital industry



U.S. had more than five million Zero-TV households

AC Nielsen reports that 42.2% of viewers in the United States own a DVR. For the first time in 20 years, Nielsen reported a decline in the number of American homes that owned a television set. 80% of American internet users had watched video online. Set-top box invented with a one-terabyte hard drive which could be used for video on demand services

Tiscali bought by Talk Talk 650 paying VOD services were operational in Europe

The average American watched approximately 153 hours of TV every month at home. 131 million Americans watched on average 3 hours of video online each month at home and work.

BBC's iPlayer launched on 25 December 2007

Sky by broadband went live on 2 January 2006 Channel 4's 4OD launched in late 2006

Telewest and NTL launched their VOD services in the United Kingdom 24.3 million people have subscribed to cable's high-speed internet service and the number of digital cable customers had grown to 27.6 million The number of Netflix members rose to 4.2 million

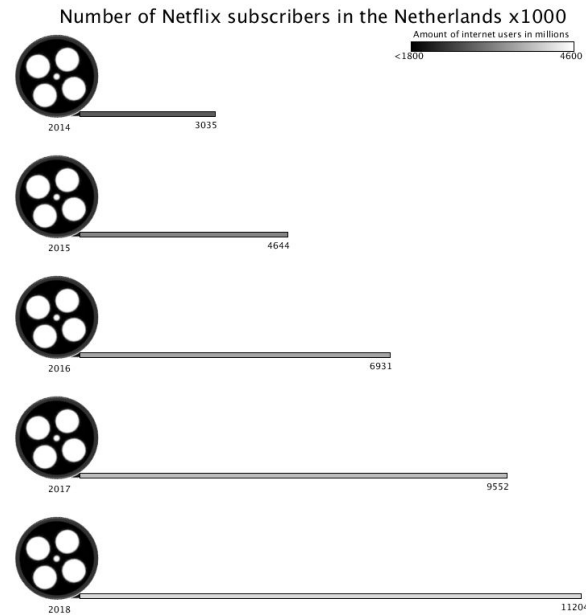
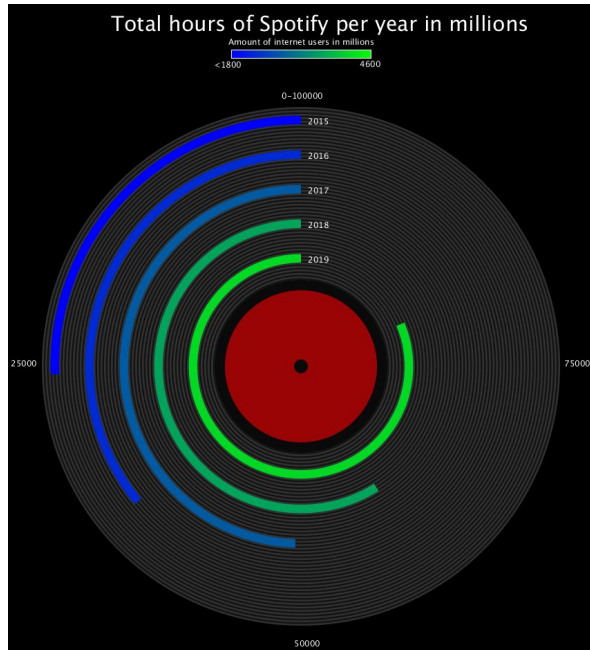
subscriptions and about 280 nationally-delivered cable networks available. 15000 subscribers Corp. creating the largest ever cable operator with more than 22 million customers

titles for one low monthly subscription. Commercial VOD service States.

Timeline of existing physical movie sites in relation to the evolution of the internet and its digital movie sites.

This graph made in Processing shows the amount of **drive-ins** and **indoor cinemas** in relation to the events regarding evolution of the internet. As can be seen there is a relatively large drop for both sites between 1997 and 2001. The info shows that in this period the amount of people acquiring Video On-Demand (VOD) devices grew exponentially, but this is also the time when Netflix launched its services. Interestingly is that after this first blow the indoor cinemas and drive-ins seem to hold up quite nicely, the rest of the progress of the internet does not seem to impact the number of physical sites.

Our ever growing usage



Our yearly devotion to the two top streaming services.

The two graphs made in Processing show nicely how the time spent on and the amount of users of the two most used streaming services in the media industry regarding music and film keeps on growing almost linearly, just as the amount of internet users worldwide each year. There is for now no end in sight and the prospect is that these numbers will keep on growing for at least the next half decade.

Cyber crime

Source data used:

<https://www-statista-com.ezproxy2.utwente.nl/statistics/465973/value-and-profit-loss-from-online-piracy-of-the-video-game-industry-in-spain/>

<https://www-statista-com.ezproxy2.utwente.nl/statistics/804853/main-reasons-leading-consumers-to-piracy-by-age-group-in-italy/>

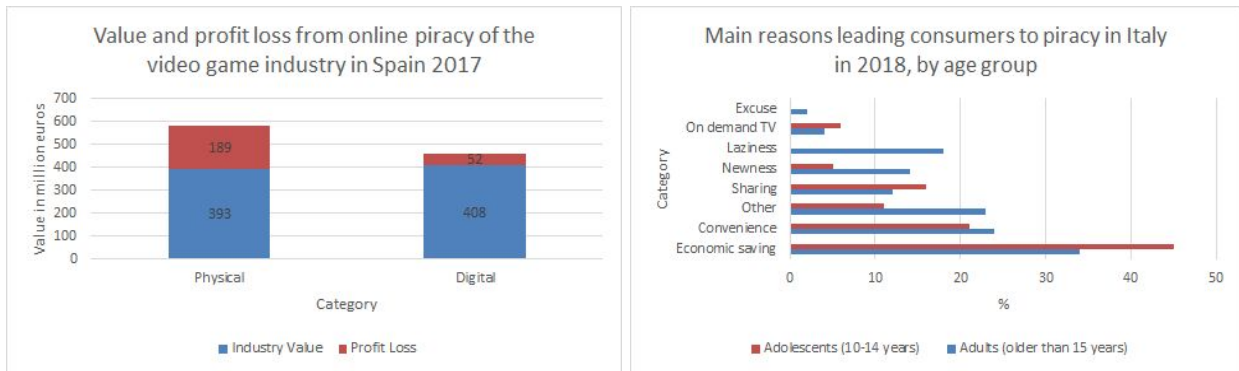
<https://www-statista-com.ezproxy2.utwente.nl/statistics/440582/ddos-attack-traffic-by-originating-country/>

<https://www-statista-com.ezproxy2.utwente.nl/statistics/440600/ddos-attack-traffic-by-industry/>

<https://www-statista-com.ezproxy2.utwente.nl/statistics/655518/industries-victims-of-ddos-attacks-in-italy/>

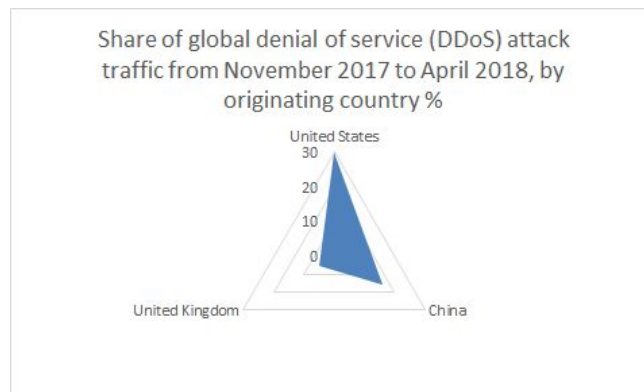
<https://www.kaggle.com/rtatman/fraudulent-email-corpus>

Online Piracy Video Game Industry



For the first visualisation I chose to combine two graphs from statista.com. The first bar chart shows the profit lost per category in red. This loss has been placed on top of the industry value. This was done as the loss is a potential profit that would have been generated. In the second visualisation, the reasoning behind pirating in the video game industry is shown. This comparison is shown as the loss in profit does not explain why videogames are pirated. Henceforth, the second graph is shown as in most cases, piracy is caused due to individual situations. For example, a big percentage of each age group pirates for economic savings. Given that these age groups are teenagers with small allowances, pirating is an easy alternative.

DDoS attacks



The second visualization focuses on (Distributed) Denial of Service (DDoS). The visualization is divided into three graphs: Type of DoS, target industry and country of origin. All of the data visualized is sourced from statista.com. However, each graph comes from a different source. When combined, these graphs show the overall picture on the DDoS situation. It is interesting to see alternative ways of breaking the law. Whilst usually crime implies stealing, DDoS attacks focus on the company itself.

Fraud email

Most common words used in fraudulent email scamming



For the final sub visualization, a word cloud was made from a sample of roughly 4000 fraud emails. I chose to focus on fraud emails as it is an indirect form of crime. Where in the previous examples, the perspective of the criminal is chosen, here the victim is highlighted. As seen in the visualization, these scammers use common financial words to draw the victims. Furthermore, in most emails, the subject relates to a lost family member. This can be seen in the visualization with words such as family, father and kin. In the original sample multiple instances of the same emails can be found, indicating that the criminals send the same email to multiple people. In contrast to the rise of the internet and the access it provides, it is easier to get attacked by criminals as well.

Cryptocurrencyer

Cryptocurrency is a digital only currency which has taken the world by storm. It became a very big market and it's a great way to make a lot of money through the internet. Even do cryptocurrencies don't have any reason to have any (There is no gold or purchasing power behind them) market value their prices are really high. This is the case because traders are willing to pay these prices for them. This results in a very unstable market and instability is profit for traders and as the internet is getting faster and faster this is becoming a better and better way to make money as a flash trader. As buying goods online and making money online is increasingly more popular than ever and will most likely not stop. Cryptocurrencies are starting to play an increasing role in this as well. It can be very risky for companies that accept cryptocurrencies on their online webshops. As there is nothing backing your currency.

Source data used:

<http://knoema.com/BITCONCS/bitcoin-currency-statistics-daily-update> 06/06/2020

<https://data.world/cnoza/cryptocurrencies> 06/06/2020

<https://www.blockchain.com/charts#network> 07/06/2020

Market value of all cryptocurrencies and the bitcoin 06/06/2020

Market value of top 100 cryptocurrencies 06/06/2020

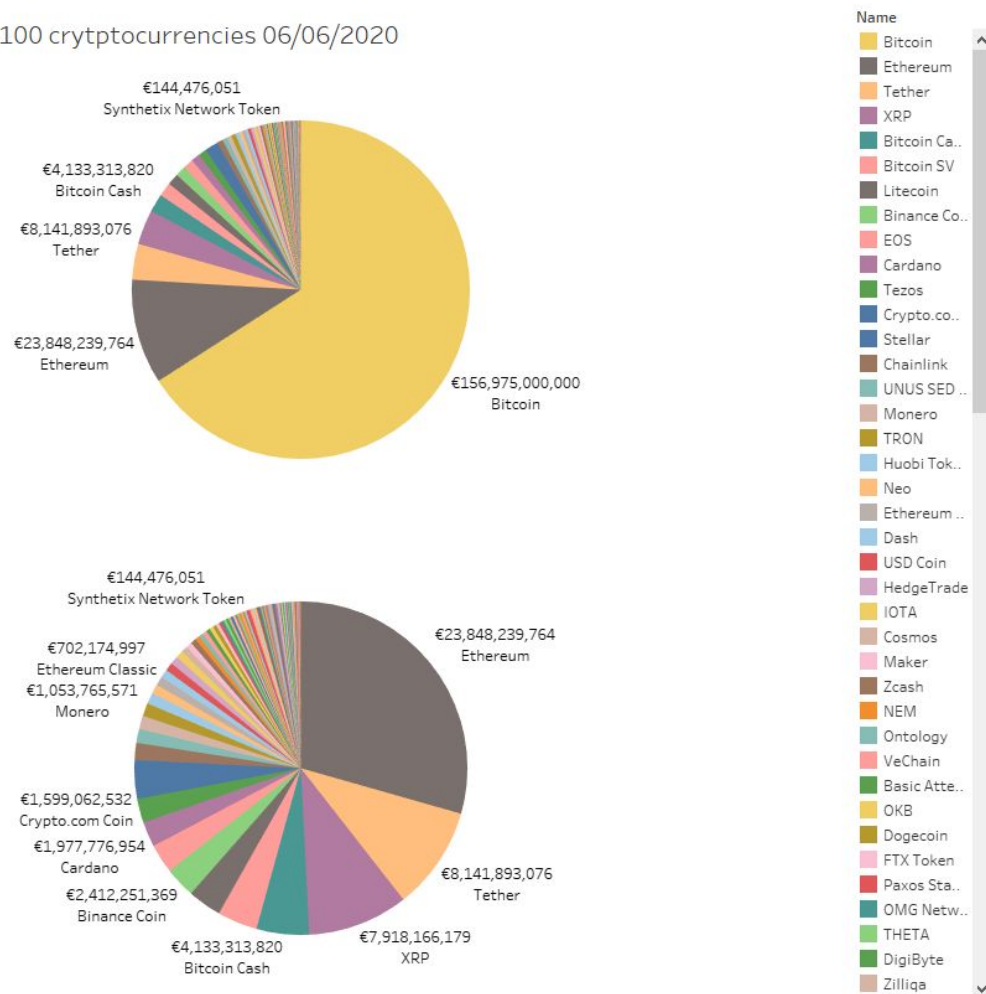


Figure X: Market value of the top 100 crypt

For the first visualization of the sub topic cryptocurrency I wanted to look into the most prominent cryptocurrencies and their market capitalization. For this I used two pie charts. One to show the overwhelming market capitalization of the bitcoin and another one to show the rest of all the cryptocurrencies.

It was rather hard to find a representation of the current cryptocurrencies in a graph. There are a lot of websites that show all of the available cryptocurrencies and their value, but the only visualization I could find was on [wikipedia](https://en.wikipedia.org/wiki/List_of_cryptocurrencies).

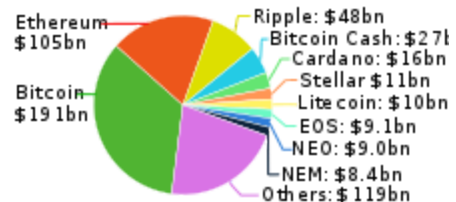


Figure X: List of cryptocurrencies

The volatility of the bitcoin

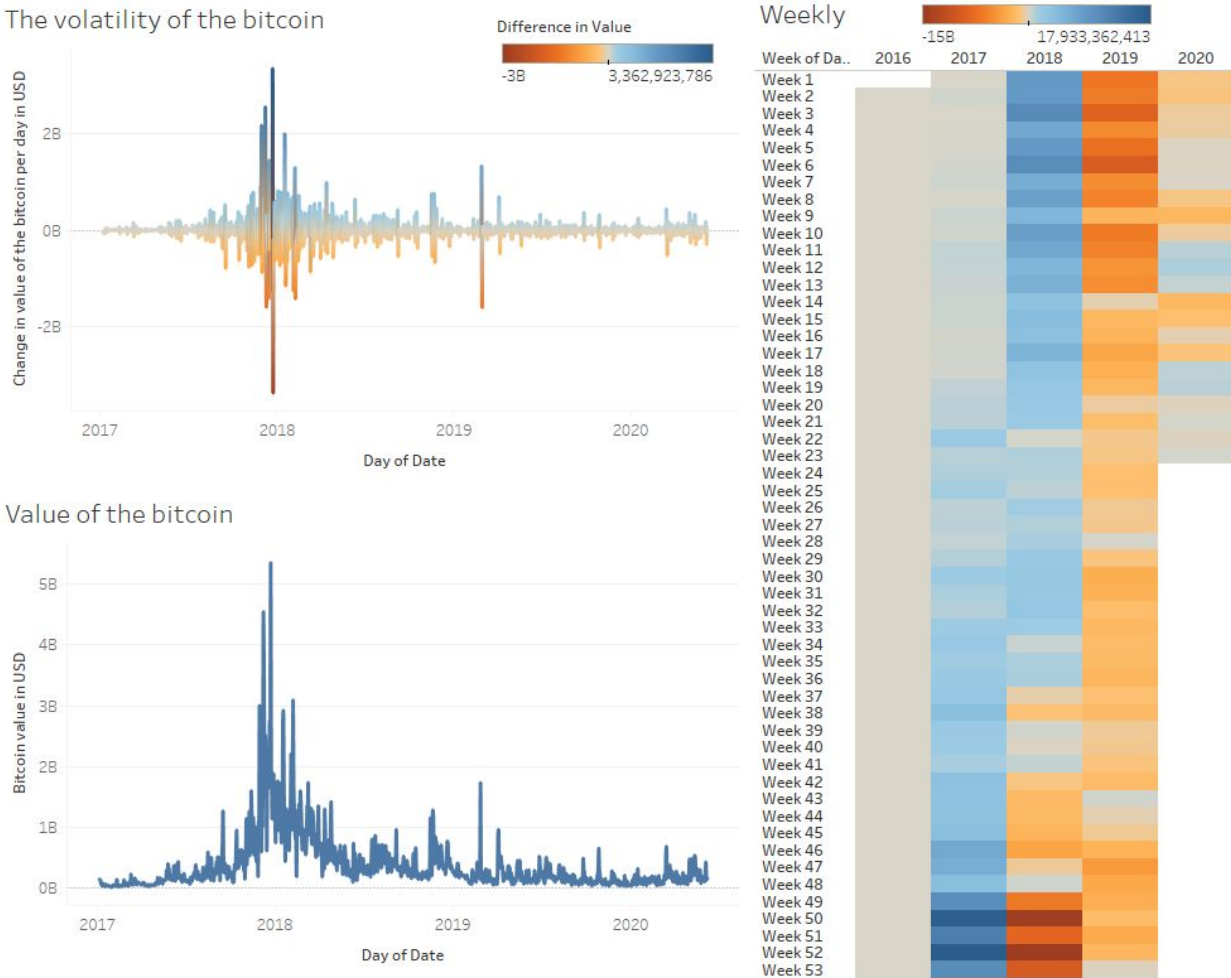


Figure X: Visualization of the market volatility of the bitcoin

For the second visualization I looked into the volatility of the bitcoin. For this I made a line graph to show the daily change of the bitcoin market capitalization and a line graph to show the daily value of the bitcoin. This way you can see that the bitcoin's value can change tremendous amounts in the time span of a singular day. The big peak you see is the 22th of december on which the bitcoin value increased with 3.36 Billion USD and on the 23th of december the value decreased with a 3.38 Billion USD. Furthermore to show that the bitcoin has somewhat of a stable growth and decrease I made a heat map which shows the weekly change in value of the bitcoin. This heatmap can be used to filter the two lines graphs to show a specific time.

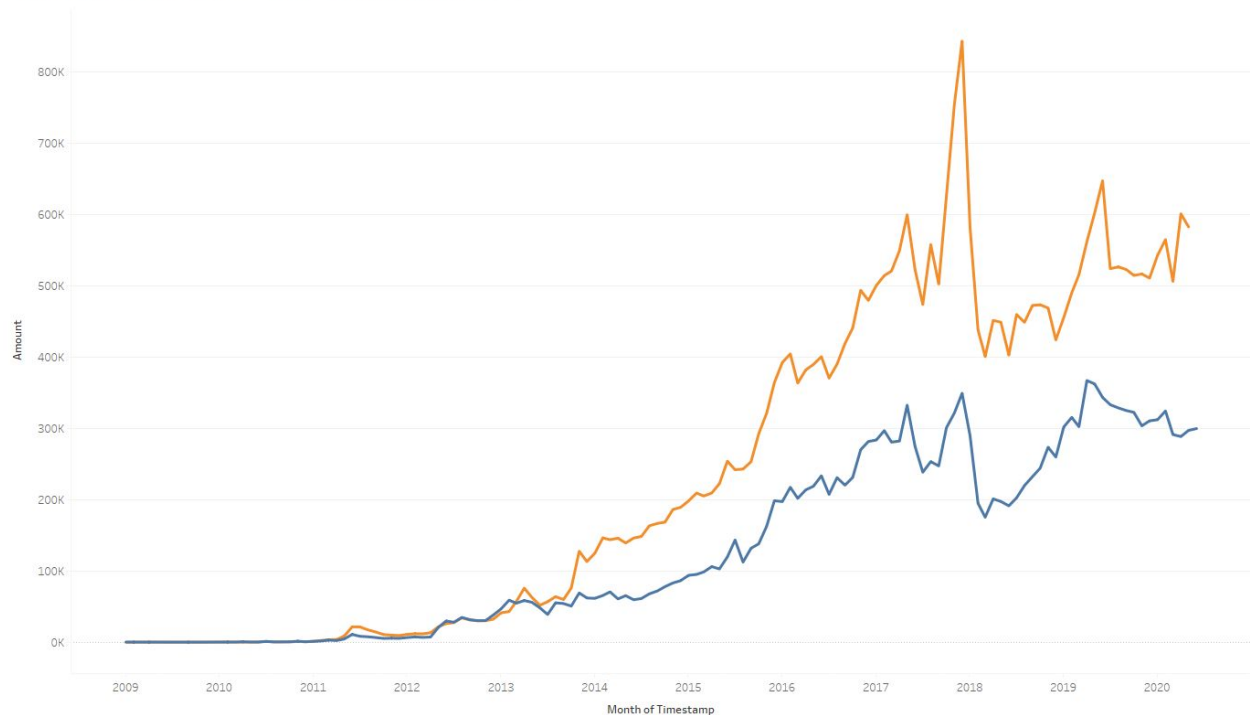
For the state of the art. An extensive amount of volatility analysis has been done for cryptocurrencies all around the internet. This has been done in every shape and form. Most of it is a year or two old, but still accurate.

https://www.researchgate.net/publication/321827427_Volatility_Analysis_of_Bitcoin_Price_Time_Series

<https://www.sciencedirect.com/science/article/pii/S1544612315001038>

Daily unique blockchain users vs daily blockchain transactions

Daily unique blockchain users vs daily blockchain transactions



The trends of Number of average daily blockchain transactions per month and Number of average daily blockchain users per month for Timestamp Month. Color shows details about Number of average daily blockchain transactions per month and Number of average daily blockchain users per month.

Number of blockchain transactions
■ Number of average daily blockchain transactions per month
■ Number of average daily blockchain users per month

Figure X: daily blockchain activity

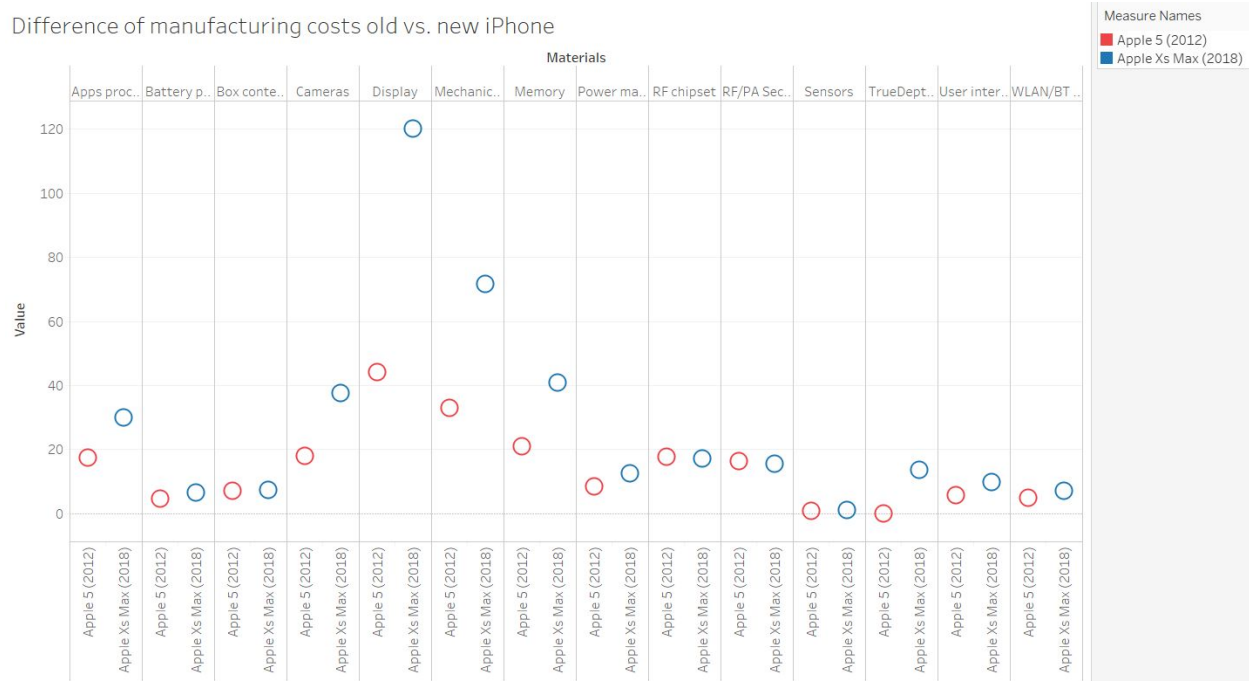
For the third visualization I made a double axis line graph. This is to show the correlation between the daily unique blockchain users(orange) and the daily amount of blockchain transactions(Blue). As you can see there are alot more users than transactions. With this you can see that a lot more people are using their account without making any transactions. This is most likely, because a lot of cryptocurrency holders keep their cryptocurrency and wait until there is a big spike in price.

While looking on the internet for a similar visualization I could not find anything.

Participation of internet on the development of economics

Source data used: <https://www.statista.com/>

Difference of manufacturing costs: old vs. new iPhone



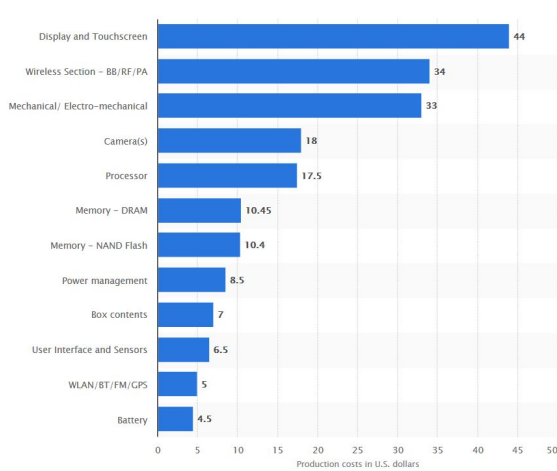
Srs : <https://www-statista-com.ezproxy2.utwente.nl/statistics/244561/manufacturing-cost-of-the-iphone-5/> iphone 5;

Srs: <https://www-statista-com.ezproxy2.utwente.nl/statistics/934633/manufacturing-costs-of-iphone-xs-max/> iphone xs max

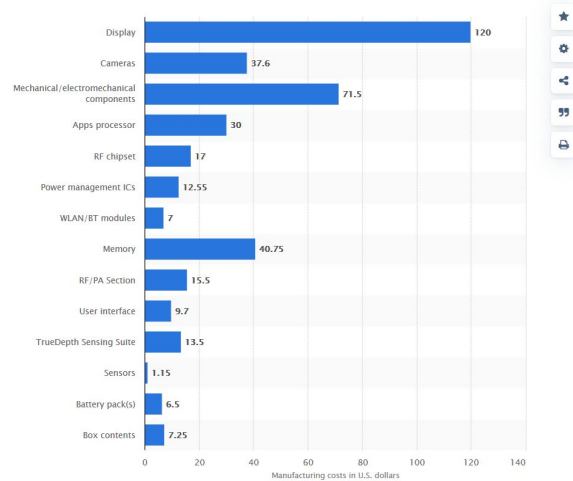
For the first visualisation for the sub-topic “participation of the internet on the development of economics”, I wanted to look at the difference in prices and quality of the iPhone. For this visualisation, I looked at the iPhone 5 from 2012 and the iPhone Xs Max from 2018. I used a scatterplot to clearly show the difference in prices. You can see that the price of manufacturing newer iPhones has been more expensive than the older one from 2012. To connect this back to the main topic of “the internet”, it shows that the iPhone has become a more important device through the years since the internet has become more and more a part of our daily lives since 2012. The materials used have become of newer and better quality which also makes it more expensive than the materials used for the older iPhone. This visualisation also has a connection to the visualisation of the total number of internet users worldwide in the sub-topic “Our ever growing usage”, since that visualisation shows more and more internet users, where the growth

of usage of the iPhone has a big role in that. This growth of usage is also an indication that these materials of the iPhone has become better and more expensive, since it is more and more used and users want better quality for their phone to have an more easy and better accessibility to the internet I chose the colors red and blue to show the clear difference between the two, the red indicates a bit that the older iPhone isn't made anymore, but there isn't really a color for old and new, so that doesn't make that much sense.

In the images below, the existing work from statistica is shown.



iPhone 5

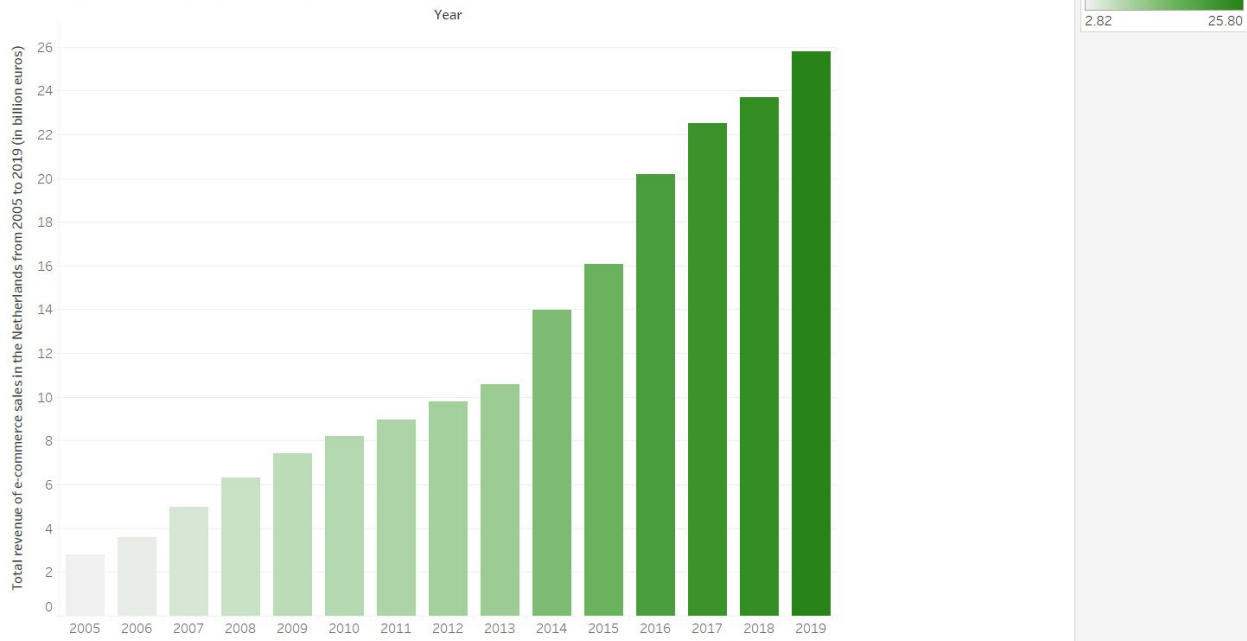


iPhone XS Max

When comparing the existing work with my own visualisation, made with Tableau, I think the scatterplot makes a good visualisation of the two different data in one plot. This way it is easier to compare the different data since everything is now in one place.

Development of e-commerce in The Netherlands

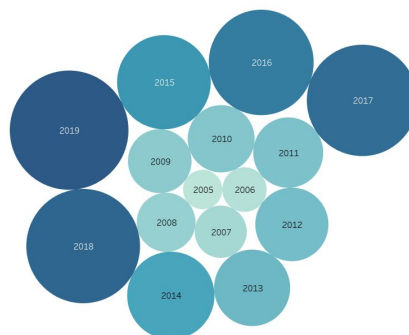
Total revenue of e-commerce sales in the Netherlands from 2005 to 2019



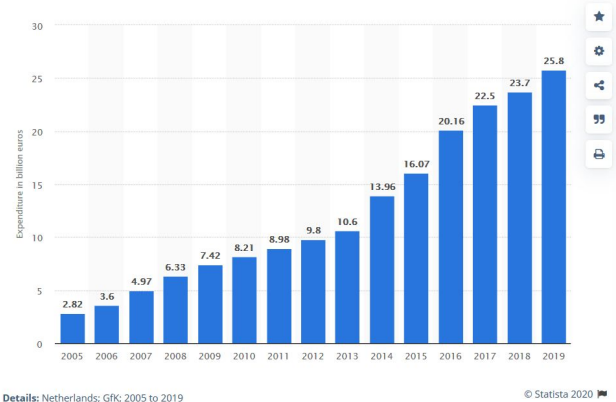
Srs:

<https://www-statista-com.ezproxy2.utwente.nl/statistics/558214/yearly-online-consumer-expenditure-in-the-netherlands/>

For this visualisation, I looked into the change of e-commerce of the Netherlands in the last fourteen years. The visualisation shown above shows a good representation of the growth of e-commerce in the Netherlands, which makes sense since the internet has become more and more important throughout the years, which is also the connection to our main topic “(the history of) the internet”. Buying goods online has become normal since the use of the internet has become a part of our daily life. The choice for the color scheme is to give a clear understanding with just one look which bar has the biggest amount of total revenue, even though this is already made quite clear by using the vertical bars-chart. This is also the reason why the vertical bars-chart is chosen, since it is a clear representation of the data. I also tried to visualize this data in a bubble chart, which was also an option but it was a bit less clear than the bar-chart above, since the years were a bit all over the place and you would have to search a bit more for the different years. E.g.:



In the image below, the existing work from statistica is shown.



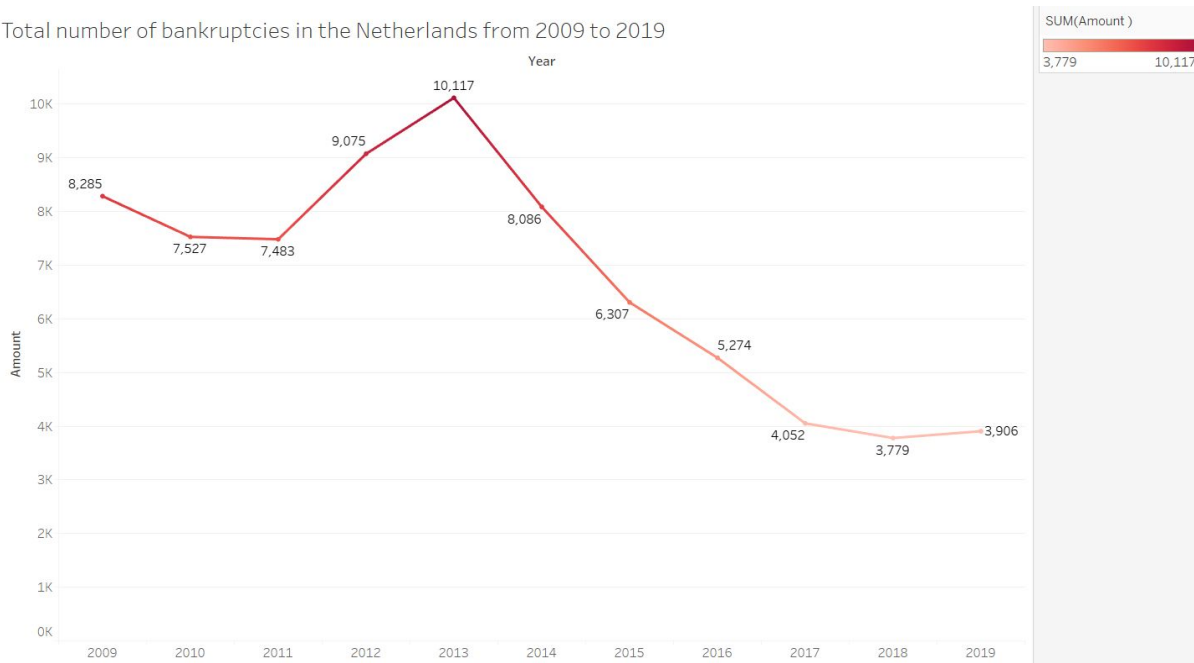
Total revenue of e-commerce sales in the Netherlands from 2005 to 2019

As you can see in this visualisation, it is very close to the visualisation I made in Tableau. The only difference is the color pattern, which I used to make it more clear for the viewer to see which year has the highest value without having to look at the numbers. Like I said, I also tried to visualise this data with the use of a bubble-chart, but found that this bubble-chart would not be clear enough for the viewer to process. So I made the decision to also choose a bar graph, since I felt this was already the best way to visualise this data.

Bankruptcies in the Netherlands

For the last visualisation, I wanted to look more if there is a negative side of how the internet has affected the economy. For this, I looked into companies which went bankrupt in the years 2009 - 2019. I assume more companies will go bankrupt in 2019 than in 2009 because there is a lot more competition, since it is quite easy to begin a company these days.

Total number of bankruptcies in the Netherlands from 2009 to 2019



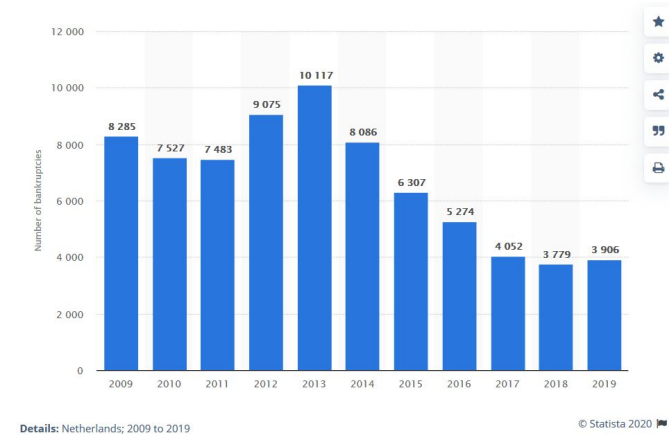
Srs: <https://www-statista-com.ezproxy2.utwente.nl/statistics/530692/total-number-of-bankruptcies-in-the-netherlands/>

Surprisingly, in the visualisation above you can see the amount of bankruptcies in the Netherlands has decreased a lot when compared to 2009, which shows a positive effect of the internet throughout the years. But there was a big increase from the year 2011 till 2013. When searching for these years on Google I found a website [2] which declared the years 2011 and 2012 of economic crisis. The Dutch economy had decreased with 1,2% in 2012, and it had a decrease of another 0,7% in 2013, which is also shown in the graph above. But the economical crisis aside, you can see that there has been a big decrease in bankruptcy. I think the internet plays a big part in this, since you used to visit a store when you wanted to buy something, but these days a lot of these companies have online stores. Besides the e-commerce aspect, it is also more easy to advertise for your company. I think it used to be quite hard to let people know you have a store, but these days with the internet, you already have a start with advertising when posting a post on your Facebook announcing you have a store. Sadly, I think there will be a big increase in bankruptcies in 2020 because of COVID-19.

For the visualisation for this data, I choose for a line-graph. This shows a nice curve and makes it easy to process. The color shows the amount of bankruptcies, which is indicated with the color red since it is quite a bad thing. The dark red shows that a lot of companies had gone away, and

the lighter red shows a less amount of bankruptcies, but this is also visualized with the values itself.

In the image below, the existing work from statistica is shown.



Total number of bankruptcies in the Netherlands from 2009 to 2019

As you can see in this visualisation, they originally used a bar graph to visualise the total number of bankruptcies in the Netherlands from 2009 to 2019. When comparing it to my own visualisation of this data, I felt it would be better to make a line-graph to visualise this data, to clearly see the ups and downs throughout the years. The colors I used also gives a bit more information about the difference in values, even though it is already clearly shown by showing the numbers itself and seeing the high difference in the line-chart, the color gives it a little extra.

References

- 1) Image Internet
<https://www.weforum.org/projects/internet-for-all>

- 2) CBS Dutch Economic
<https://www.cbs.nl/nl-nl/nieuws/2013/37/de-nederlandse-economie-2012>