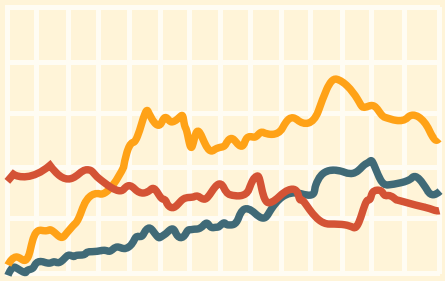
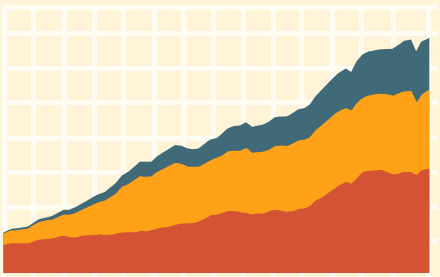
There are many ways to visualize data that change over time. In this comic, we'll look at three of them.

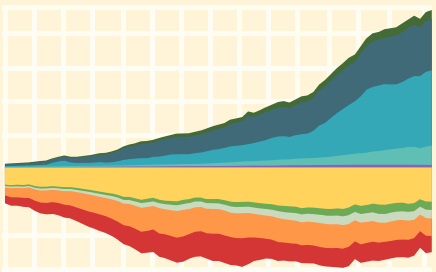
LINE CHART



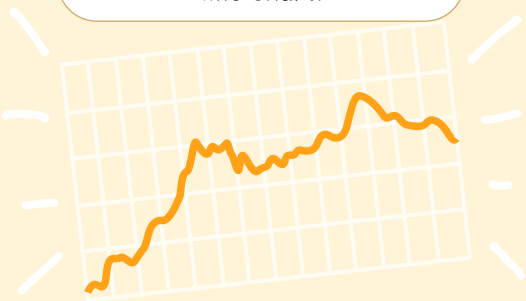
AREA CHART



STREAM GRAPH

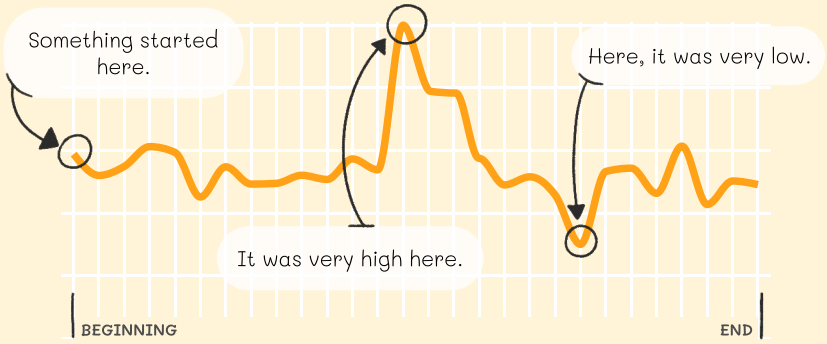


Let's start with the line chart.



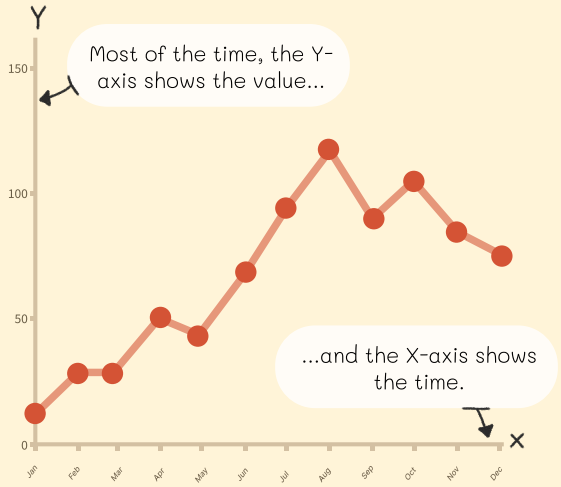
It's one of the most well-known charts - maybe you know it already?

A line chart is good at showing how a value changes over time.

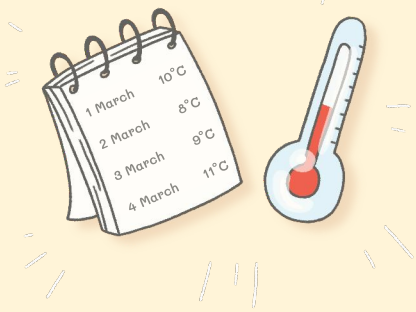


But how do you create a line chart?

Generally, a line chart consists of connected data points in a coordinate system.



Let's look at the example of temperature data.



Date	Temperature
1 March	10°C
2 March	8°C
3 March	9°C
4 March	11°C

This table records the temperatures for each day in March.

Date	Temperature
1 March	10°C
2 March	8°C
3 March	9°C
4 March	11°C

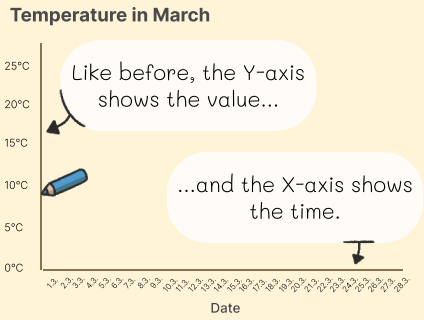
One row of the table is a data point.

Date	Temperature
1 March	10°C
2 March	8°C
3 March	9°C
4 March	11°C

We see the date...

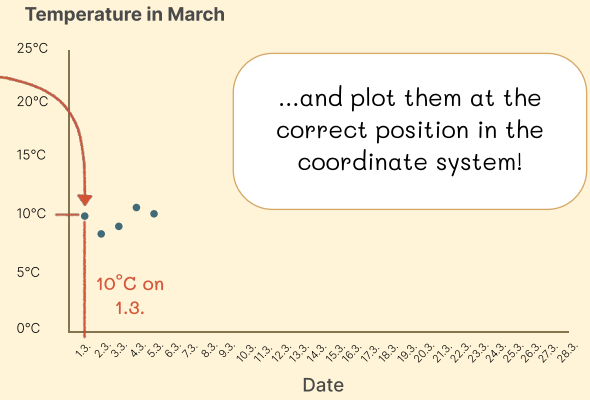
...and a corresponding value.

To present the data clearly, we draw a coordinate system.

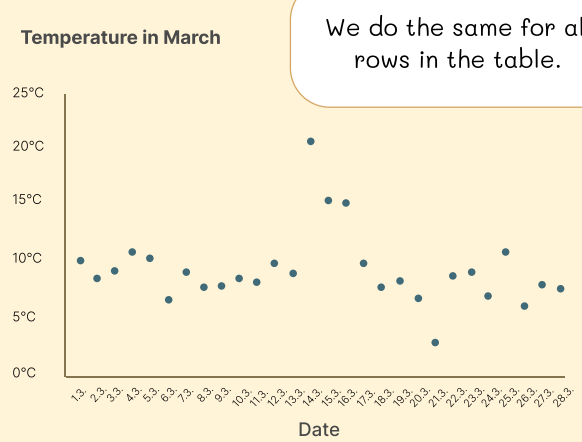


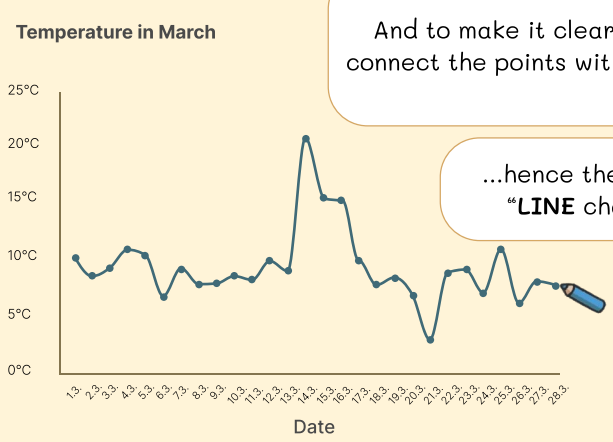
Date	Temperature
1 March	10°C
2 March	8°C
3 March	9°C
4 March	11°C
5 March	10°C

Then, we read the date and value for each data point...

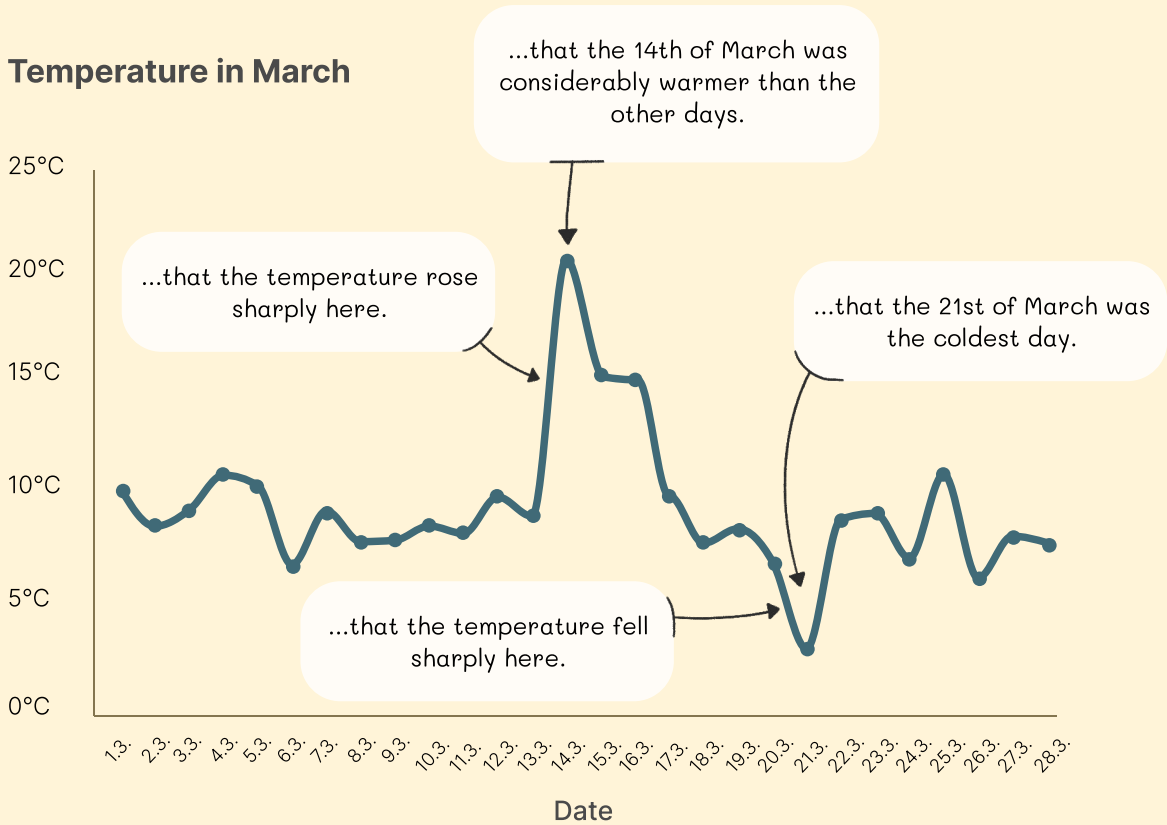


...and plot them at the correct position in the coordinate system!

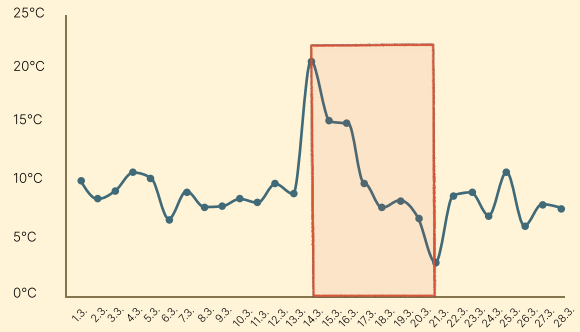




From our completed line graph, we can now read a lot of information, for example...

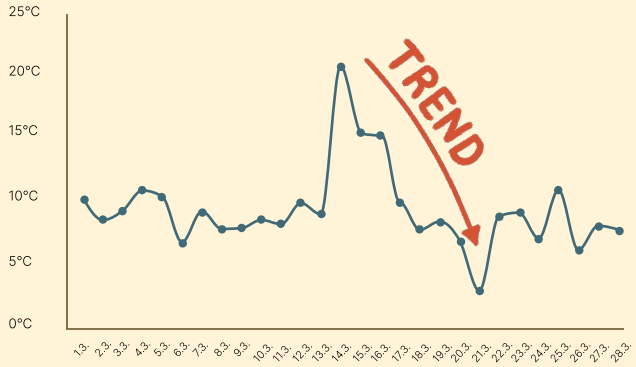


It's also interesting to look at how a value developed over multiple days.

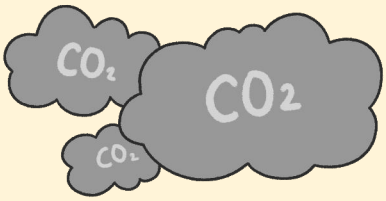


For example, we can see that it got progressively colder between the 14th and the 21st of March.

Such a temporal development of a value - that is, where it moves in a specific direction over a period of time, is called a **TREND**.

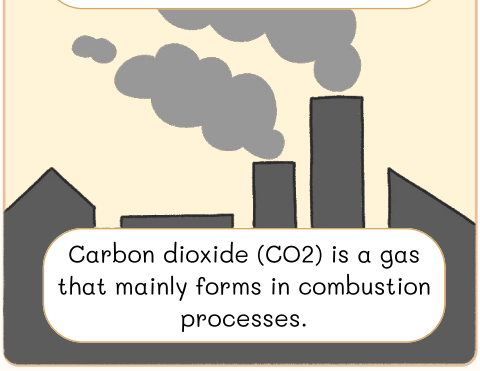


Let's look at another example.

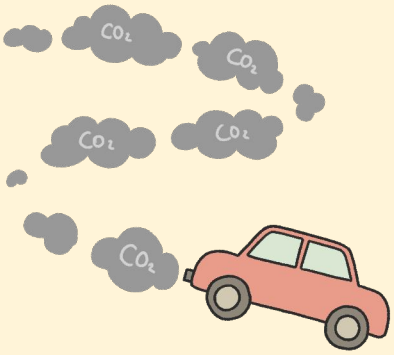


It's about how CO2 emissions per person in Europe have changed over time.

CO2 emissions happen when carbon dioxide (CO2) is released into the air.



Carbon dioxide (CO2) is a gas that mainly forms in combustion processes.



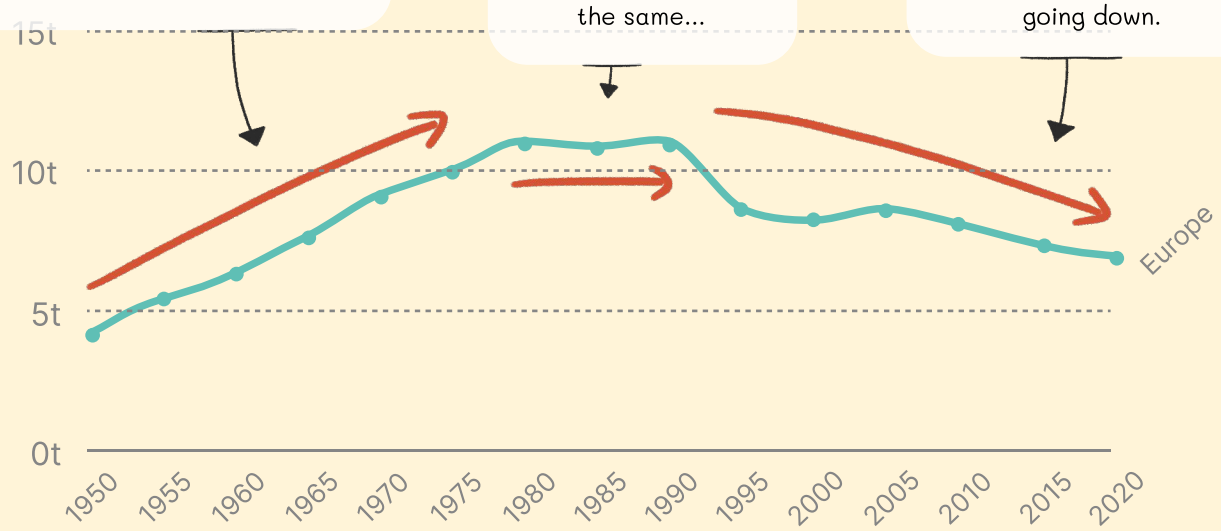
For example, when fuel is burned in the engine of a car, it emits CO2.

CO2 emissions in tons per person - Europe

So, if we look at the CO2 emissions from 1950 to 1980, we see a **RISING TREND**, because the line in the diagram rises.

From 1980 to 1990, emissions stay mostly the same...

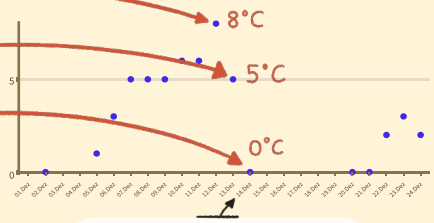
...but from 2005 onwards, we see a slight **DECREASING TREND**, and emissions are going down.



Depending on the data, values might also be negative.

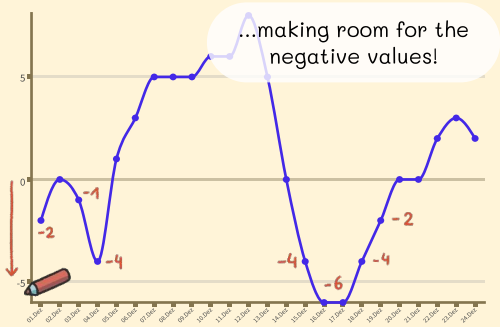
12 December	8 °C
13 December	5 °C
14 December	0 °C
15 December	-4 °C
16 December	-6 °C

In a temperature diagram, for example, temperatures in winter could fall below zero.

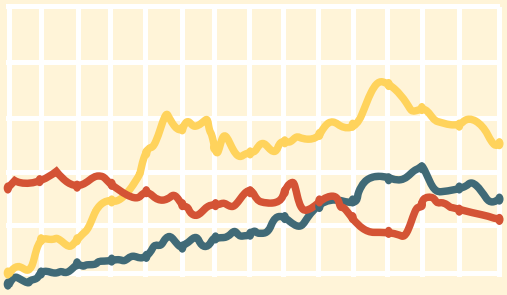


Here's zero - but where to put degrees below that?

In such cases, the Y-axis can simply be extended downwards, below the point of zero...



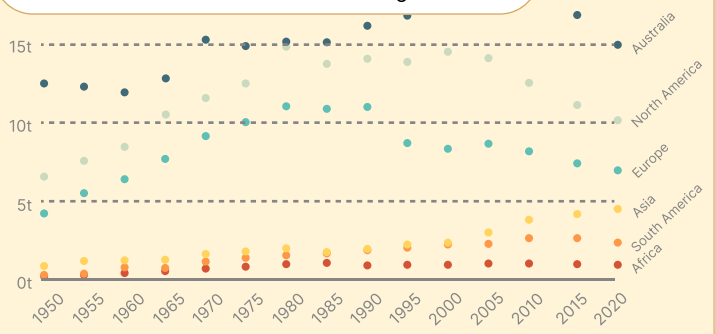
A line chart can also contain multiple lines. The advantage of this is that you can compare multiple developments.



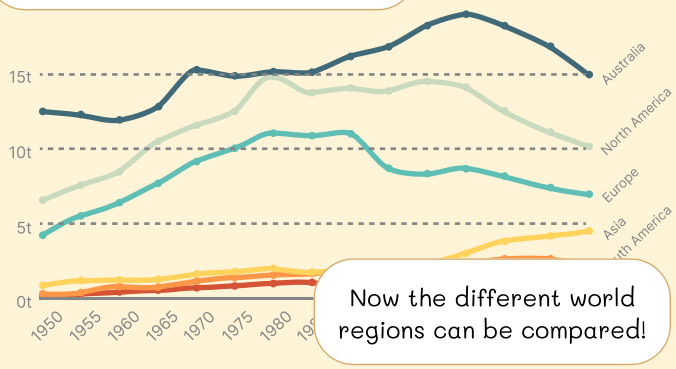
For example, we could not only plot the CO2 emissions of Europe in the diagram, but also those of different world regions!

Year	Europe	Australia	Asia	other regions
1950	4,8 t	12,5 t	1,8 t	
1955	5,2 t	12,4 t	1,9 t	
1960	6,2 t	12,2 t	1,9 t	
1965	7,5 t	12,7 t	1,9 t	

To do this, all the individual points are once again plotted in the coordinate system. Different colours are used for better distinction of the regions.

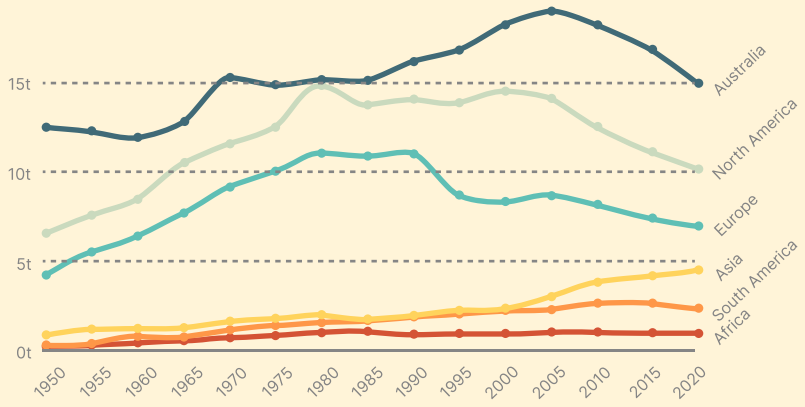


Then, all points of the same colour are connected with a line.



Now the different world regions can be compared!

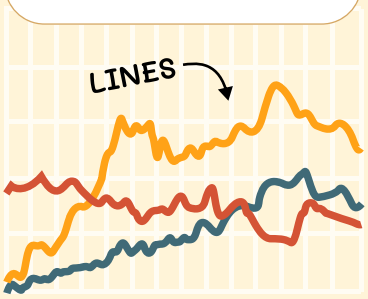
CO2 emissions in tons per person - world regions



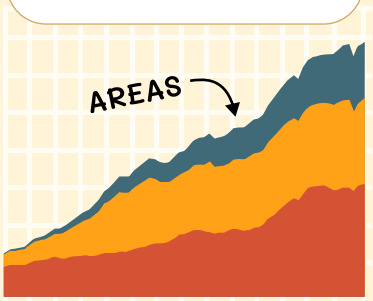
You can now see that **Australia**, **North America** and **Europe** emit much more CO2 per person than **Asia**, **South America** and **Africa**!

Additionally, you can see the global changes of CO2 emissions at a glance. These are also called **GLOBAL TRENDS**.

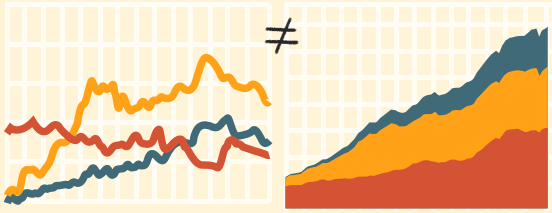
In addition to the line chart...



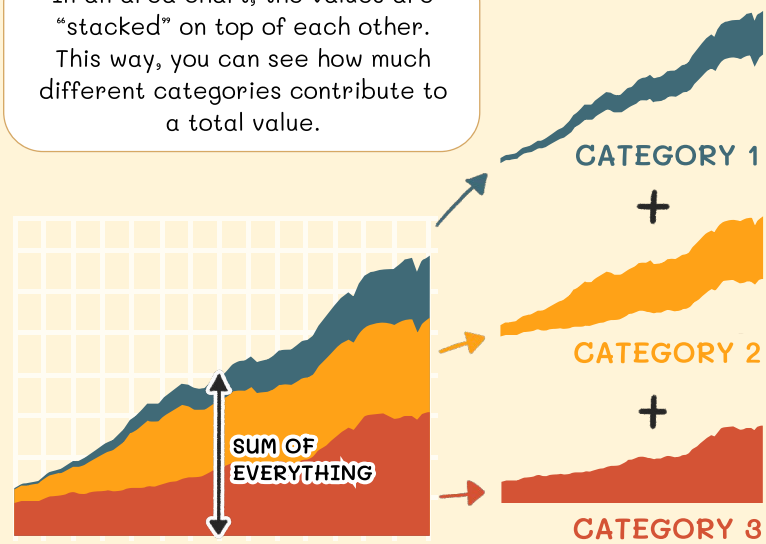
...there is also the area chart.



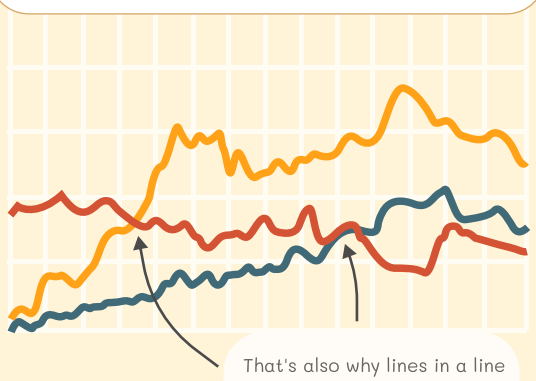
At first glance, the two look very similar, but there is still an important difference.



In an area chart, the values are "stacked" on top of each other. This way, you can see how much different categories contribute to a total value.

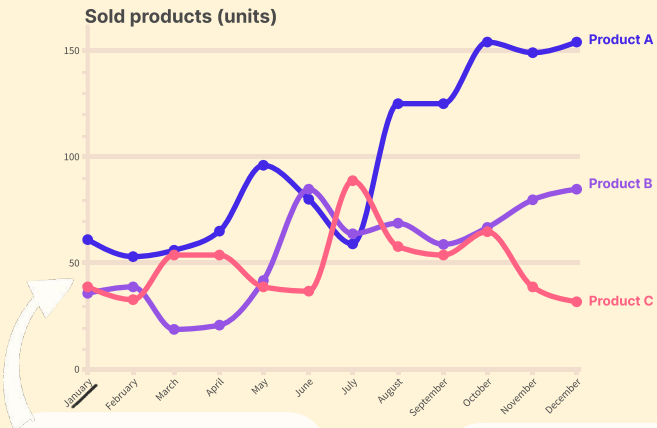


In a line graph, you can't see a total value because all categories are separate and not stacked.



That's also why lines in a line chart can cross, whereas areas in an area chart cannot.

Let's look at an example. Here, we see a line chart like we know it already.



In January, **61 units** of Product A...

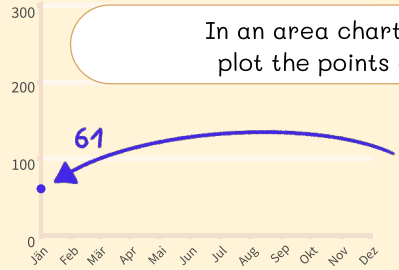
...and **40 units** of Product C were sold.

...**37 units** of Product B...

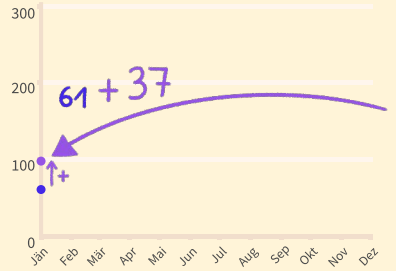
Month	Product A	Product B	Product C
January	61	37	40

So, in total, **138 units** of all products.

In an area chart, you would plot the points as follows:



61 units of Product A...



PLUS
37 units of Product B...

PLUS
40 units of Product C.

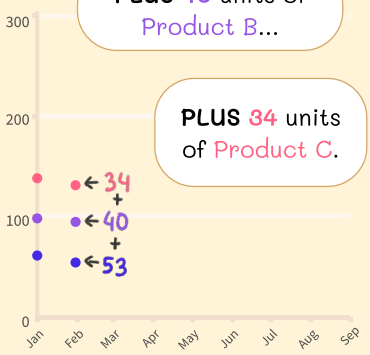
Let's do the same thing again for February.

Month	Product A	Product B	Product C
Jan	61	37	40
Feb	53	40	34
Mar	56	20	55
Apr	65	22	55

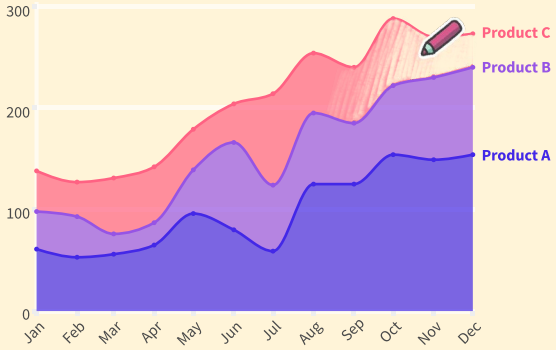
53 units of Product A...

PLUS 40 units of Product B...

PLUS 34 units of Product C.

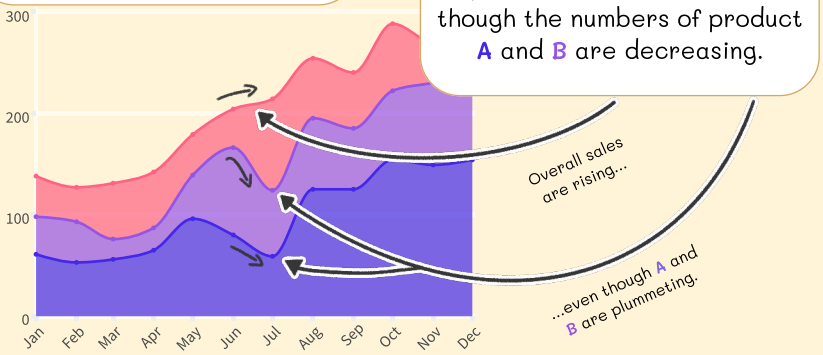


In the end, all the points of the same colour are connected, and the areas are colored in so that the quantities are clearly visible.

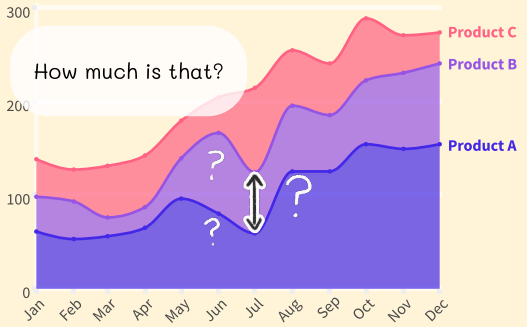


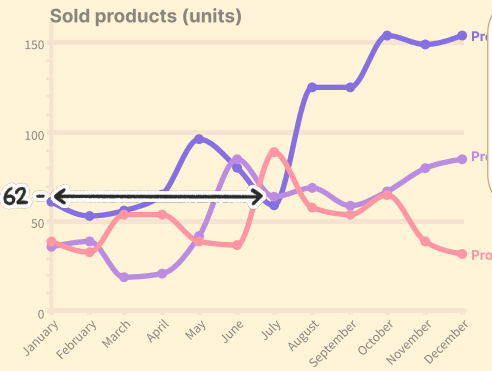
The main advantage of "stacking" the values is that you can always see a total value.

For example, here we can see that the overall sales of products increases, even though the numbers of product A and B are decreasing.



On the flipside, it's difficult to determine exactly how many units of an individual product were sold.

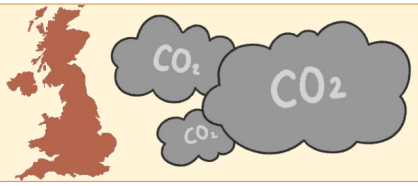




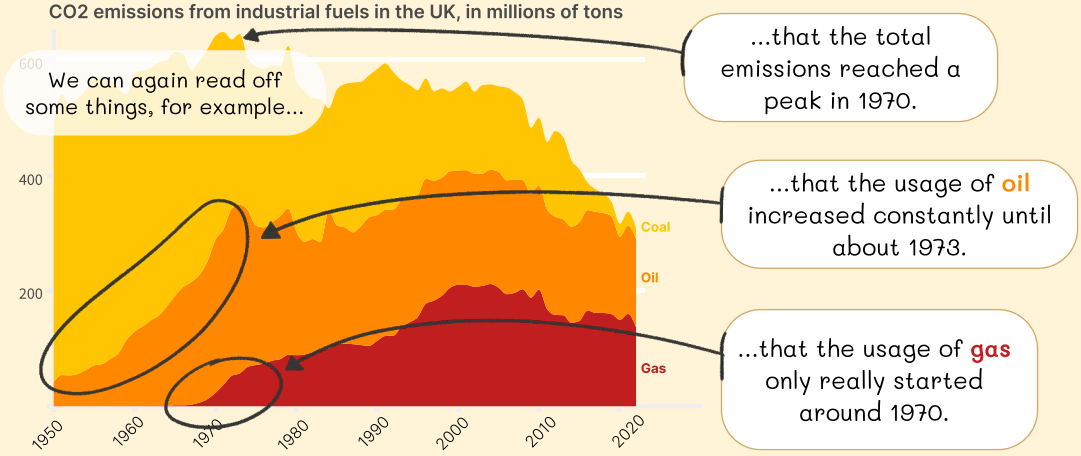
In the line graph, however, that's not a problem – we just need to find the point and read the value on the axis.

Ah, it's about 62 units!

Finally, let's look at another example with CO2 emissions.



This time, it's about how much the burning of different materials contributes to CO2 emissions in the UK.



We can again read off some things, for example...

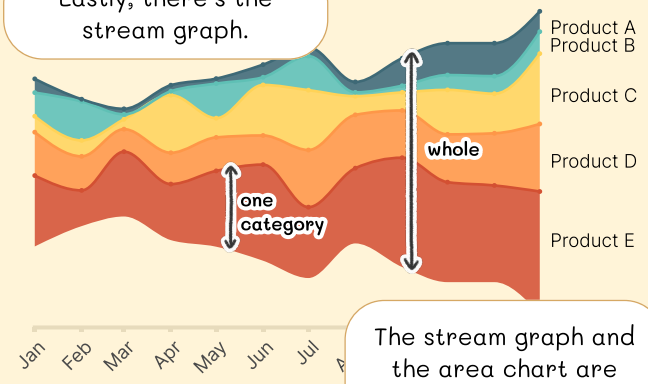
...that the total emissions reached a peak in 1970.

...that the usage of oil increased constantly until about 1973.

...that the usage of gas only really started around 1970.

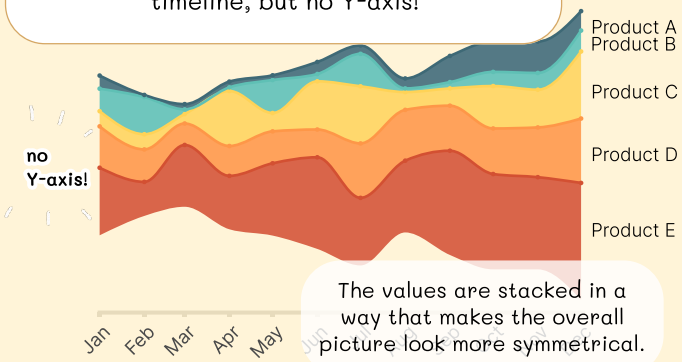
Perhaps you'll find even more insights in the diagram yourself!

Lastly, there's the stream graph.



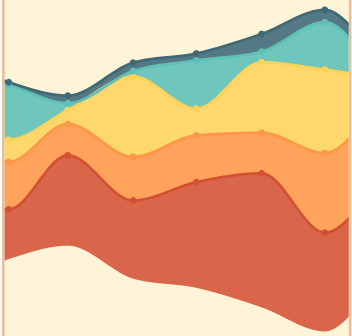
The stream graph and the area chart are very similar.

However, the values are not plotted in a coordinate system – there is a timeline, but no Y-axis!



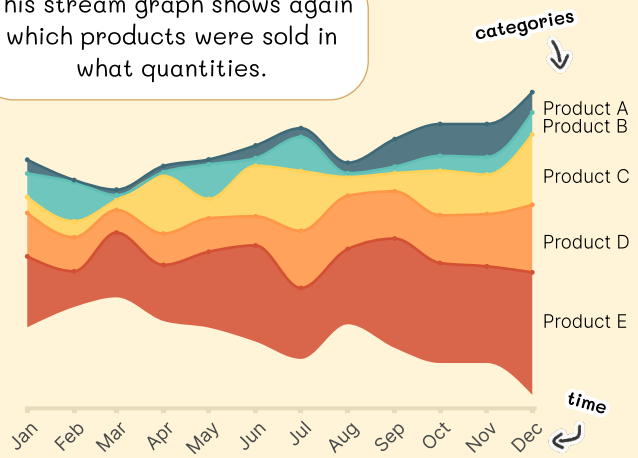
The values are stacked in a way that makes the overall picture look more symmetrical.

This makes the visualization look a bit like waves in a river...



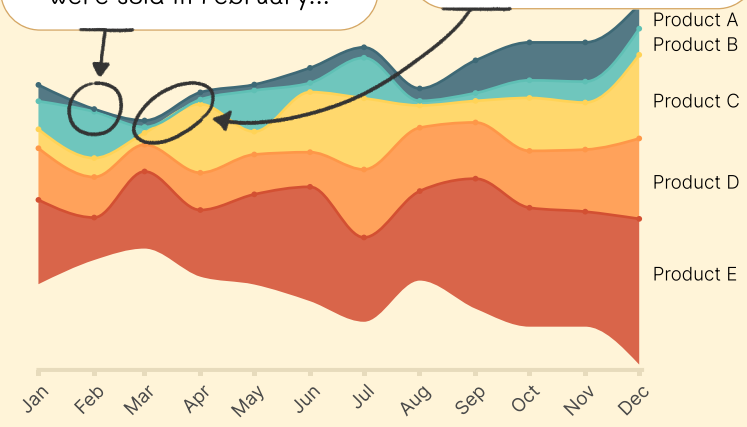
...hence the name "**stream** graph".

This stream graph shows again which products were sold in what quantities.



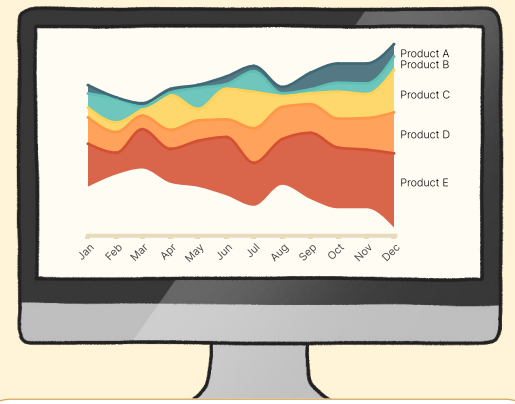
For example, you can see that almost no units of Product A were sold in February...

...and that almost no units of Product B were sold between March and April.



Exact values cannot be read off due to the missing Y-axis, so the stream graph only provides a rough overview!

The symmetrical placement of the areas in stream graphs, so they look nice, is almost impossible to do manually.



That's why they are usually created with a computer, which calculates it automatically.

Now you know the differences between these three ways of displaying data that change over time: **line graphs**, **area charts**, and **stream graphs**!

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FWF Österreichischer Wissenschaftsfonds

CO2 data source: https://ourworldindata.org/grapher/co2-by-source