

# Visual Information Design

## Pie charts and their alternatives

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In this edition of our series “Visual Information Design – How to Create Meaningful Reports”, which will appear every two weeks from the beginning of February 2017 to the end of March 2017, we would like to look at the representation of pie charts. We will answer the following questions:

- When does it make sense to use pie charts?
- What do you need to pay attention to when using this type of graphic?
- What alternatives to pie charts are there?

Pie charts have been used to represent proportions and distributions for over 200 years.

The first use of pie chart dates back to 1801, over 200 years ago. The goal was to represent a (territorial) distribution.<sup>1</sup> Nothing has changed about the purpose of pie charts, even today. Pie charts are used for distributions or proportions, and the total of all the slices equals 100%. It is also possible to add spatial components to make a “cake chart”, which displays the pie chart in 3D. However, as far as we’re concerned, cake is best left for dessert, not for representing distributions and proportions. Why? A) 3D “cake” charts allow room for interpretation, and B) they often lead to incorrect conclusions. We will demonstrate why below.

Besides pie charts, so-called donut charts have also become established recently. We will disregard this representation in this series, since it offers no new insights and only differs from a pie chart by the open space in the middle.

### 1. When do pie charts make sense, and what do you need to pay attention to?

We recommend using at most five slices in a pie chart so the slices can be compared to each other.

In the next step, we consider when it makes sense to use a pie chart. Since the pie chart is divided into individual slices (also called circle sectors), the number of individual slices must be restricted to ensure a form that can be displayed and read. As a guideline, we recommend displaying five slices in a pie chart. Otherwise, it is barely possible to compare the slices. Furthermore, it is advisable to read the pie like a clock and start with the first slice at “12 o’clock”.

The following pie chart is shown as an example for clarification:

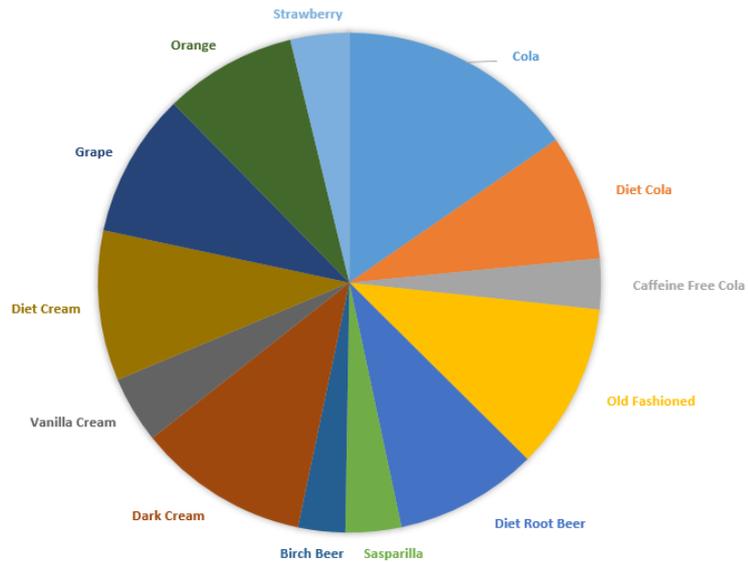


Fig. 1: Pie chart for representing the distribution of revenue by different products, without key or title

A large number of slices prevents easy comparison; it only communicates a rough idea.

Now let us ask: which product accounts for the largest share? Which one comes in second, and what are the next-largest shares? Cola's value (light blue) is presumably the highest, followed maybe by Dark Cream (brownish colour) or Old Fashioned (light yellow). Or maybe Diet Cream (dark yellow)? Which has a higher value: Orange (dark blue) or Diet Cola (orange)? Here we already see the challenges of a large number of slices and similar values.

Now let us look at a 3D "cake" version this pie chart. Do we now draw the same conclusion as from the 2D pie chart? Which share is the largest, and which ones follow?

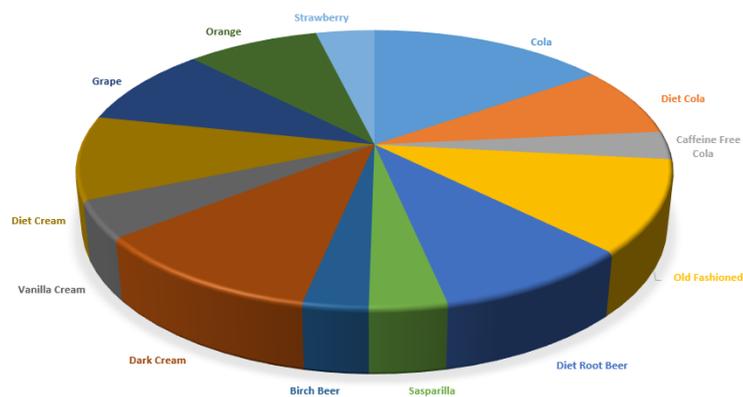


Fig. 2: 3D "cake chart" for representing the distribution of revenue by different products, without key or title.

3D representations distort the information.

Can we now conclude that Dark Cream's share is larger than Cola's? Or are we deceived by the reddish-brown colour? Is Old Fashioned's share now larger than Cola's?

3D representations distort the display of the results and leave unnecessary room for interpretation. Thus cakes are best for dessert, not a form of visualisation

## 2. What alternatives to pie charts are there?

But what if we chose a different representation for comparing proportions? For example, a bar chart with a neutral colour for each bar? Besides better legibility of the proportions, this also ensures that no (signal) colours lead the eye astray.

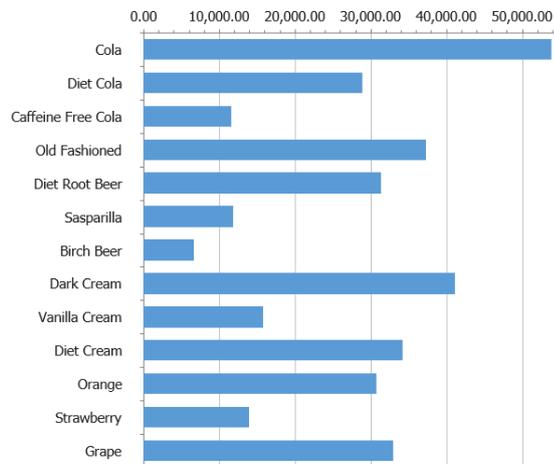


Fig. 3 Bar chart for representing the distribution of revenue by different products, without key or title.

Horizontal bar charts offer an alternative to pie charts. They can represent the same information content as pie charts, or even better information content.

The actual ratio can be seen here. Furthermore, the ranking is clear and very easy to see. Clearly, any pie chart can be represented as a horizontal bar chart. Furthermore, in this alternative representation, we can dispense with colour differences, which have no meaning in the above example of the pie chart. Bar charts give you the option of representing negative values well. Have you ever tried to do that with a pie chart? Pie charts view every value as an absolute value and thus cannot represent negative values. You can convince yourself of this in Excel.

In addition, the values and percentages can be indicated in the respective representations. The bar chart could be sorted by rank, for example.

### Summary

Pie charts can be used for simplified representations of up to five proportions. However, it is necessary to consider whether the quantity represented can also have negative values. If so, pie charts are not an option. In general you should dispense with any 3D representation. Any pie chart can be represented as a horizontal bar chart. This also allows you to reduce the number of colours, which significantly improves legibility and is especially important for displaying reports clearly. Use a title for better readability as well.

You can find further helpful tips for representing information better in our Visual Information Design series.

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## Sources

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<sup>1</sup> Playfair, William (2005): Playfair's Commercial and Political Atlas and Statistical Breviary. New York: Cambridge University Press.