Learning Enhancement Team

Steps into Statistics

Pie Charts

This guide describes pie charts and how to present them. It also discusses the data types and situations for which they are appropriate.

Introduction

Presenting data in a visually pleasing and meaningful way is very important in statistics. You should remember that a diagram or chart is there to communicate your numerical data to an audience. One of the simplest charts you can use is a **pie chart**. Pie charts were introduced over 200 years ago by William Playfair who believed that numerical data presented in tables was easily forgotten or misunderstood. In response to this he developed a number of visual aids for data presentation including the pie chart and bar chart. The idea of the pie chart was famously extended by Florence Nightingale to illustrate the need to implement sanitary conditions in field hospitals in the Crimean War. Whilst the pie chart has been criticised in recent years, without it design-led data representations (such as those created by *Information is Beautiful*) would not be possible.

What is a pie chart?

A pie chart uses a circle to represent your data. The circle is divided into sectors whose proportions reflect the relative proportions of the data with respect to an overall total. Commonly, raw data are converted to percentages and so the whole circle represents 100% (pie chart on the left below). However this is not always the case and often the raw data are used (pie chart on the right below).

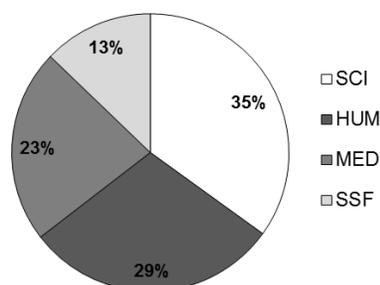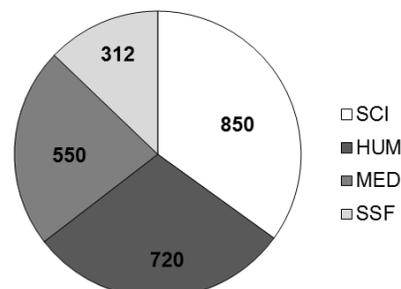Chart to show proportion of visitors from each faculty to the Students' Union in 2012

Chart to show number of visitors from each faculty to the Students' Union in 2012

A pie chart should have a clear title and a key which helps the reader to identify which parts of the pie chart relate to which data. For example you should be able to tell that the pie charts on the first page of this study guide represent the data in table 1.

Faculty	Number of visitors to Students' Union	Percentage
HUM	720	29%
MED	550	23%
SCI	850	35%
SSF	312	13%

Table 1: The number of visitors to a Students' Union from particular faculties in 2012.

The largest sector should start at 12 o'clock and the sectors should reduce in size as you go clockwise around the chart. You should make the differences between the *slices of the pie* clear. Often colours or patterns are used but you should remember that they should not detract from the presentation of the data itself.

As a complete circle has an angle of 360°, if you are using a pie chart to represent percentages, each contribution of 1% is represented by an angle of 3.6°. If you are using your pie chart to represent raw data you need to divide 360 by the total of your data to find what each single piece of data represents. Any computer program which produces a pie chart should do these calculations for you.

You can use a pie chart when you have a **discrete** data set. They are not suitable for continuous data. Pie charts are most effective for **nominal** or **ordinal** level data with **no more than 6 categories**. For more guidance on levels of data see the study guide: *Levels of Data*.

Problems with pie charts

When the distinction between the sizes of the sectors of a pie chart are clear then it works well as a visual device. However when this is not the case the pie chart fails in its main aim, to communicate data to an audience. You should consider using an alternative way of presenting your data, such as a bar chart, if:

(i)   you have segments of similar sizes. The human eye is better at distinguishing between heights than difference between angles.

(ii)   you have many categories.

(iii) you have categories with low counts or proportions which lead to thin segments in your pie chart.

For more details about bar charts see the study guide: *Bar Charts*.

There are also many options available in computer programs, such as 3D and exploding effects, which enhance the visual appeal of a pie chart. You may wish to avoid these options as they not only act as a diversion from any message you may wish to convey from your data but, in some cases, they actually distort the sizes of the sectors. The pie chart below, which also represents the data from table 1, has some effects added to it.

Chart to show proportion of visitors from each faculty to the Students' Union in 2012
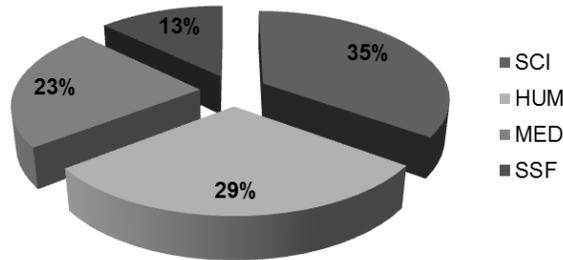
Even though SCI has the largest sector (35%), the 3D effect, coupled with the explosion, has exaggerated the HUM sector and it appears larger. Even though it may look more appealing, the pie chart above is failing to communicate the data faithfully.

Sometimes though a simple effect can be very helpful in presenting data. Consider the following breakdown of the 850 SCI students from table 1 given in table 2.

School	Number
Biology (BIO)	194
Chemistry (CHE)	95
Environmental Science (ENV)	138
Mathematics (MTH)	120
Pharmacy (PHA)	253

Table 2: The breakdown of SCI students who visited a Students' Union in 2012 into school.

A subtle use of an explosion and a slightly different key can communicate the extra information effectively, as shown in the pie chart below.

Chart to show proportion of visitors from each faculty to the Students' Union in 2012
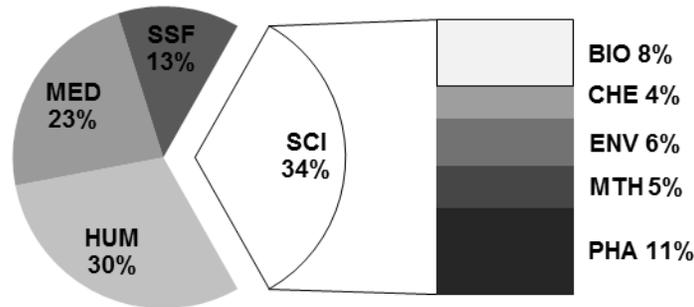
Want to know more?

If you have any further questions about this topic you can make an appointment to see a **Learning Enhancement Tutor** in the **Student Support Service**, as well as speaking to your lecturer or adviser.

①   Call: 01603 592761
🖥   Ask: ask.let@uea.ac.uk
☞   Click: https://portal.uea.ac.uk/student-support-service/learning-enhancement

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