

Exercises:

Introduction to ggplot2

Version 2021-09

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## Exercise 1: Simple point and line plots

Load the data from the weight\_chart.txt file. This is a tab delimited text file. You’ll need to use library(tidyverse) to load the tidyverse functions, then set the working directory with Session > Set Working Directory > Choose Directory in RStudio then use read\_delim() to load the file and save it to a variable.

This file contains the details of the growth of a baby over the first few months of its life.

* Draw a scatterplot (using geom\_point) of the Age vs Weight. When defining your aesthetics the Age will be the x and Weight will be the y.
* Make all of the points filled with blue2 by putting a fixed aesthetic into geom\_point() and give them a size of 3
* You will see that an obvious relationship exists between the two variables. Change the geometry to geom\_line to see another way to represent this plot.
* Combine the two plots by adding both a geom\_line and a geom\_point geometry to show both the individual points and the overall trend.

Load the data for the chromosome\_position\_data.txt file

* Use pivot\_longer to put the data into tidy format, by combining the three data columns together. The options to pivot\_longer will be:
  + The columns to restructure: cols=Mut1:WT
  + The name of the new names column: names\_to="Sample"
  + The name of the values column: values\_to="Value"
* Draw a line (geom\_line) graph to plot the position (x=Position) against the value (y=Value) and splitting the Samples by colour (colour=Sample). Use the size attribute in geom\_line to make the lines slightly thicker than their default width.

### If you have time

* Load in the genomes.csv file and use the separate function to turn the Groups column into Domain, Kingdom and Class based on a semicolon delimiter.
* Plot a point graph of log10(Size) vs Chromosomes and colour it by Domain

## Exercise 2: Barplots and Distributions

Load the data from small\_file.txt using read\_delim

* Plot out a barplot of the lengths of each sample from category A
  + Start by filtering the data to keep only Sample A samples
    - small %>% filter(Category == "A")
  + Pass this filtered tibble to ggplot
  + Your x aesthetic will be Sample and your y will be length
  + Since the value in the data is the bar height you need to use geom\_col
* Plot out a barplot (using geom\_bar) of the mean length for each category in small.file
  + You will need to set stat="summary", fun="mean" in geom\_bar so it plots the mean value
* Add a call to geom\_jitter() to the last plot so you can also see the individual points
  + Colour the points by Category and decrease the width of the jitter columns to get better separation. Make sure height is set to 0
  + If you don’t want to see the legend then you can set show.legend=FALSE in geom\_jitter.

Load the data from expression.txt using read\_delim.

* Plot out the distribution of Expression values in this data. You can try both geom\_histogram and geom\_density. Try changing the color and fill parameters to make the plot look prettier. In geom\_histogram try changing the binwidth parameter to alter the resolution of the distribution.

Load the data from cancer\_stats.csv using read\_delim.

* Plot a barplot (geom\_col) of the number of Male deaths for all Sites. (x=Site, y=`Male Deaths`) make sure you let the RStudio auto-complete help you to fill in the Male Deaths column name so you get the correct backtick quotes around it.
* You won’t be able to show all of the categories so just show the first 5 (cancer %>% slice(1:5) %>% ggplot…)

### If you have time

Create a new variable in child.variants loaded from Child\_Variants.csv called Good using mutate and if\_else. The value should be “GOOD” if QUAL == 200 otherwise it should be “BAD”

Plot out a violin plot, using geom\_violin() of the MutantReads for the two Good categories.

## Exercise 3: Annotation, Scaling and Colours

Use theme\_set to set your ggplot theme to be theme\_bw with a base\_size of 12. Replot one of your earlier plots to see how its appearance changed.

In the cancer barplot you did in exercise 2 you had to exclude sites because you couldn’t show them on the x axis. Use the coord\_flip transformation to switch the x and y axes so you can remove the slice function which restricted you to 5 sites, and show all of the sites again.

Load the data from brain\_bodyweight.tsv

* Plot a scatterplot of the brain against the body
* Change the axis labels (xlab and ylab) to say Brainweight (g) and Bodyweight (kg) and add a suitable title (ggtitle).
* Both brainweight and bodyweight are better displayed on a log scale – try implementing this in one of the ways below
  + Turn the axes into log scale axes (scale\_x\_log10 and scale\_y\_log10)
  + Modify the data to be log transformed when creating the aesthetic mapping (pass the column name into log10() when defining the aesthetic mapping in aes())
  + Use mutate to modify the original data before passing it to ggplot
* Color the plot by Category, and change the colours to use the ColorBrewer “Set1” palette (scale\_colour\_brewer)
* Change the ordering of the categories to be “Domesticated”, “Wild”, “Extinct”

### If you have time

Create a barplot of the brainweight of all species, coloured by their bodyweight. Use a custom colour scheme for the colouring of the bars. You will again need to use a log scale for the brain and bodyweight.

## Exercise 4: Summary Overlays

Load the data in treatments.csv with read\_delim.

* Plot a stripchart of the four conditions using geom\_jitter()
* Overlay a boxplot of the same data along with the raw points
  + Adjust the size and width of spread of the points in geom\_point to something sensible
  + Adjust the size of the lines in the boxplot
  + Make sure geom\_boxplot is drawn first so you can see everything
  + Try colouring the points by the condition to see if it’s any clearer.
* Plot the same data as a barplot with errorbars for the SEM
  + Use a geom\_bar for the barplot with stat=”summary” and then use stat\_summary with a geometry of errorbar with the default mean\_se values.

### If you have time

Take the same treatment data and pre-calculate a mean and sd from it using group\_by and summarise. Use these pre-calculated values to plot out the same barplot as before.

Replot the stripchart, but instead of overlaying a boxplot, use stat\_summary to just add a bar to indicate the mean.

## Exercise 5: Faceting and Highlighting

Load the data in up\_down\_expression.txt

* Plot out a scatterplot of Condition1 vs Conditon2 coloured by State
* Change the coloring using scale\_colour\_manual so that up is red, unchanging is grey and down is blue
* Add text labels to the following genes
  + Col1A2, TCL1B, SPTSSB, SULF2
  + Filter the full dataset using up\_down %>% filter( Gene %in% c("Col1A2", "etc" )) and save the result
  + Pass the filtered dataset to the data option of geom\_text. Make sure you added label=Gene to your aesthetic mappings
  + Colour the labels black and use hjust=1.2 to position them to be readable away from the actual points, or use geom\_text\_repel to adjust the positions automatically.
* Use geom\_abline to put a null line across the diagonal (slope=1, intercept=0)

Load the data in DownloadFestival.csv

* Draw a stripchart (geom\_jitter) of the cleanliness values for males and females separately
* Use facet\_grid(cols=vars(day)) to split the plot based on the day of the festival to see the effect this had on the data
* Make some additions to the plot
  + Colour the male samples red and the female samples blue
  + Add a line to show the mean by using a stat summary

### If you have time

Add a new column called attendance to the data to say how many days people attended the festival. To do this you will need to:

1. Group by the person
2. Use count to get a count of how many times each person occurred
3. Use right\_join to merge the counts back into the original data
4. Rename the n column to attendance

Now redraw the plot but faceting by both attendance and day