□ ggplot2 axis ticks : A guide to customize tick marks and labels

□ Discussion □ Tools

The goal of this **tutorial** is to describe how to customize **axis tick marks** and **labels** in **R software** using **ggplot2** package.

Data

ToothGrowth data is used in the examples hereafter.

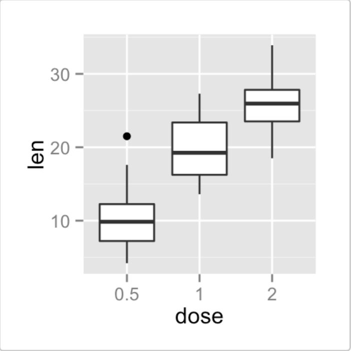
```
# Convert dose column from numeric to factor variable
ToothGrowth$dose <- as.factor(ToothGrowth$dose)
head(ToothGrowth)
```

```
##    len supp dose
## 1  4.2   VC  0.5
## 2 11.5   VC  0.5
## 3  7.3   VC  0.5
## 4  5.8   VC  0.5
## 5  6.4   VC  0.5
## 6 10.0   VC  0.5
```

□ Make sure that *dose* column are converted as a factor using the above R script.

Example of plots

```
library(ggplot2)
p <- ggplot(ToothGrowth, aes(x=dose, y=len)) + geom_boxplot()
p
```



Change the appearance of the axis tick mark labels

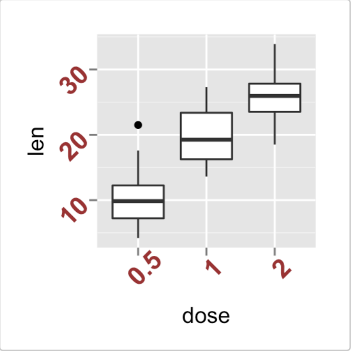
The **color**, the **font size** and the **font face** of axis tick mark labels can be changed using the functions **theme()** and **element_text()** as follow :

```
# x axis tick mark labels
p + theme(axis.text.x= element_text(family, face, colour, size))

# y axis tick mark labels
p + theme(axis.text.y = element_text(family, face, colour, size))
```

The following arguments can be used for the function *element_text()* to change the appearance of the text :

- **family** : font family
- **face** : font face. Possible values are “plain”, “italic”, “bold” and “bold.italic”
- **colour** : text color
- **size** : text size in pts
- **angle** : angle (in [0, 360])

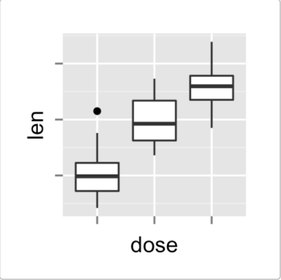
```
# Change the appearance and the orientation angle
# of axis tick labels
p + theme(axis.text.x = element_text(face="bold", color="#993333", 
                           size=14, angle=45),
          axis.text.y = element_text(face="bold", color="#993333", 
                           size=14, angle=45))
```

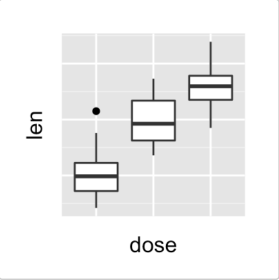


Hide x and y axis tick mark labels

axis ticks and **tick mark labels** can be removed using the function **element_blank()** as follow :

```
# Hide x an y axis tick mark labels
p + theme(
  axis.text.x = element_blank(),
  axis.text.y = element_blank())

# Remove axis ticks and tick mark labels
p + theme(
  axis.text.x = element_blank(),
  axis.text.y = element_blank(),
  axis.ticks = element_blank())
```





Change axis lines

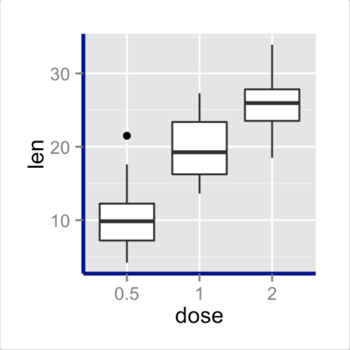
Axis lines can be changed using the function **element_line()** as follow :

```
p + theme(axis.line = element_line(colour, size, linetype,
                                   lineend, color))
```

The arguments of **element_line()** are :

- **colour**, **color** : line color
- **size** : line size
- **linetype** : line type. **Line type** can be specified using either text (“blank”, “solid”, “dashed”, “dotted”, “dotdash”, “longdash”, “twodash”) or number (0, 1, 2, 3, 4, 5, 6). Note that linetype = “solid” is identical to linetype=1. The available line types in R are described in this post : Line type in R software
- **lineend** : line end. Allowed values for line end are : “round”, “butt” or “square”

```
# Change the line type and color of axis lines
p + theme( axis.line = element_line(colour = "darkblue",
                      size = 1, linetype = "solid"))
```



Set axis ticks for discrete and continuous axes

x or y axis can be discrete or continuous. In each of these two cases, the functions to be used for setting axis ticks are different.

Customize a discrete axis

The functions **scale_x_discrete()** and **scale_y_discrete()** are used to customize discrete x and y axis, respectively.

It is possible to use these functions to change the following x or y axis parameters :

- axis titles
- axis limits (data range to display)
- choose where tick marks appear
- manually label tick marks

The simplified formats of **scale_x_discrete()** and **scale_y_discrete()** are :

```
scale_x_discrete(name, breaks, labels, limits)

scale_y_discrete(name, breaks, labels, limits)
```

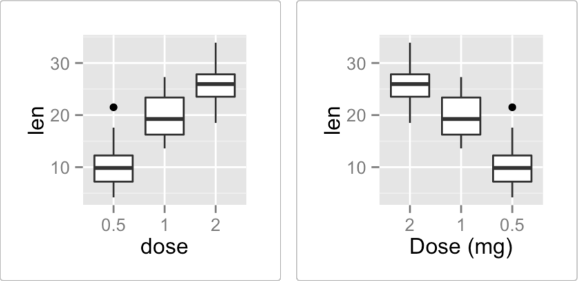
- **name** : x or y axis labels
- **breaks** : control the breaks in the guide (axis ticks, grid lines, …). Among the possible values, there are :
  - *NULL* : hide all breaks
  - **waiver()** : the default break computation
  - a **character** or **numeric** vector specifying which breaks to display
- **labels** : labels of axis tick marks. Allowed values are :
  - **NULL** for no labels
  - **waiver()** for the default labels
  - **character vector** to be used for break labels
- **limits** : a character vector indicating the data range

□ Note that, in the examples below, we'll use only the functions **scale_x_discrete()** and **xlim()** to customize x axis tick marks. The same kind of examples can be applied to a discrete y axis using the functions **scale_y_discrete()** and **ylim()**.

Change the order of items

The argument *limits* is used to change the order of the items :

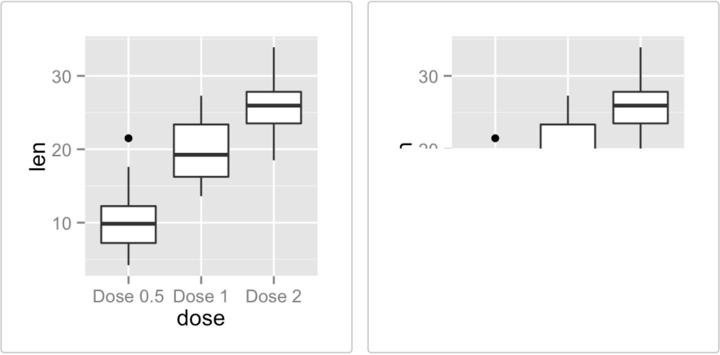
```
# default plot
p

# Change the order of items
# Change the x axis name
p + scale_x_discrete(name ="Dose (mg)",
                    limits=c("2","1","0.5"))
```



Change tick mark labels

The name of tick mark texts can be changed as follow :

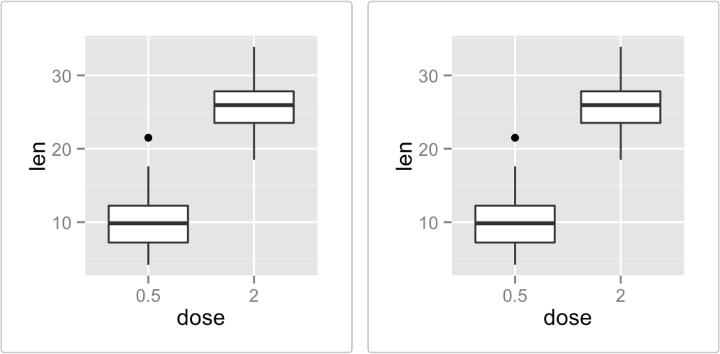
```
# Solution 1
p + scale_x_discrete(breaks=c("0.5","1","2"),
        labels=c("Dose 0.5", "Dose 1", "Dose 2"))

# Solution 2 : same plot as solution 1
p + scale_x_discrete(labels=c("0.5" = "Dose 0.5", "1" = "Dose 1",
                              "2" = "Dose 2"))
```



Choose which items to display

The R code below shows the box plot for the first item (dose = 0.5) and the last item (dose = 2) :

```
# Solution 1
p + scale_x_discrete(limits=c("0.5", "2"))

# Solution 2 : same result as solution 1
p + xlim("0.5", "2")
```



Customize a continuous axis

The functions **scale_x_continuous()** and **scale_y_continuous()** are used to customize continuous x and y axis, respectively.

Using these two functions, the following x or y axis parameters can be modified :

- axis titles
- axis limits (set the minimum and the maximum)
- choose where tick marks appear
- manually label tick marks

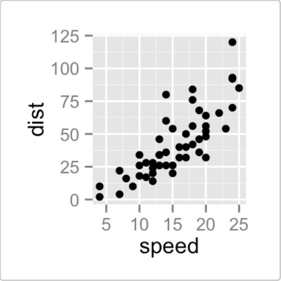
The simplified formats of **scale_x_continuous()** and **scale_y_continuous()** are :

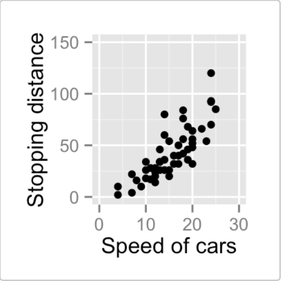
```
scale_x_continuous(name, breaks, labels, limits, trans)

scale_y_continuous(name, breaks, labels, limits, trans)
```

- **name** : x or y axis labels
- **breaks** : control the breaks in the guide (axis ticks, grid lines, …). Among the possible values, there are :
    - *NULL* : hide all breaks
    - **waiver()** : the default break computation
    - a **character** or **numeric** vector specifying the breaks to display
- **labels** : labels of axis tick marks. Allowed values are :
    - **NULL** for no labels
    - **waiver()** for the default labels
    - **character vector** to be used for break labels
- **limits** : a numeric vector specifying x or y axis limits (min, max)
- **trans** for axis transformations. Possible values are “log2”, “log10”, “sqrt”, etc

These functions can be used as follow :

```
# scatter plot
sp<-ggplot(cars, aes(x = speed, y = dist)) + geom_point()
sp

# Change x and y axis labels, and limits
sp + scale_x_continuous(name="Speed of cars", limits=c(0, 30)) +
  scale_y_continuous(name="Stopping distance", limits=c(0, 150))
```

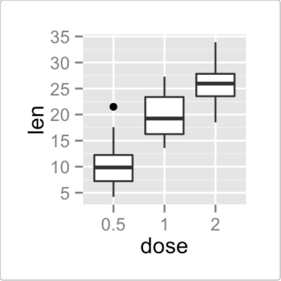


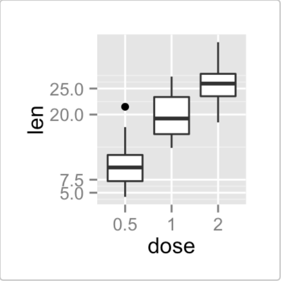


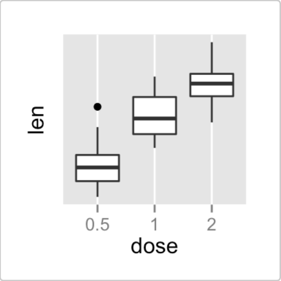
Set the position of tick marks

The R code below set the position of tick marks on the y axis of the box plot. The function **scale_y_continuous()** and the argument **breaks** are used to choose where the tick marks appear :

```
# Set tick marks on y axis
# a tick mark is shown on every 5
p + scale_y_continuous(breaks=seq(0,40,5))

# Tick marks can be spaced randomly
p + scale_y_continuous(breaks=c(5,7.5, 20, 25))

# Remove tick mark labels and gridlines
p + scale_y_continuous(breaks=NULL)
```



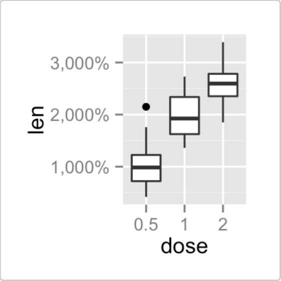


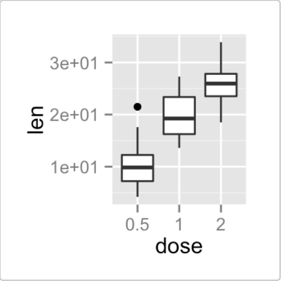


Format the text of tick mark labels

Tick mark labels can be formatted to be viewed as percents, dollars or scientific notation. The package **scales** is required.

```
library(scales)

# Format labels as percents
p + scale_y_continuous(labels = percent)

# Format labels as scientific
p + scale_y_continuous(labels = scientific)
```





□ Possible values for labels are comma, percent, dollar and scientific. For more examples, read the documentation of the package *scales* : ?scales::trans_new

Infos

□ This analysis has been performed using **R software** (ver. 3.1.2) and **ggplot2** (ver.)

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