ggplot2

an implementation of the **grammar of graphics**

BioDICée Lab

Pierre Gaüzère
ISEM | BioDICée Team

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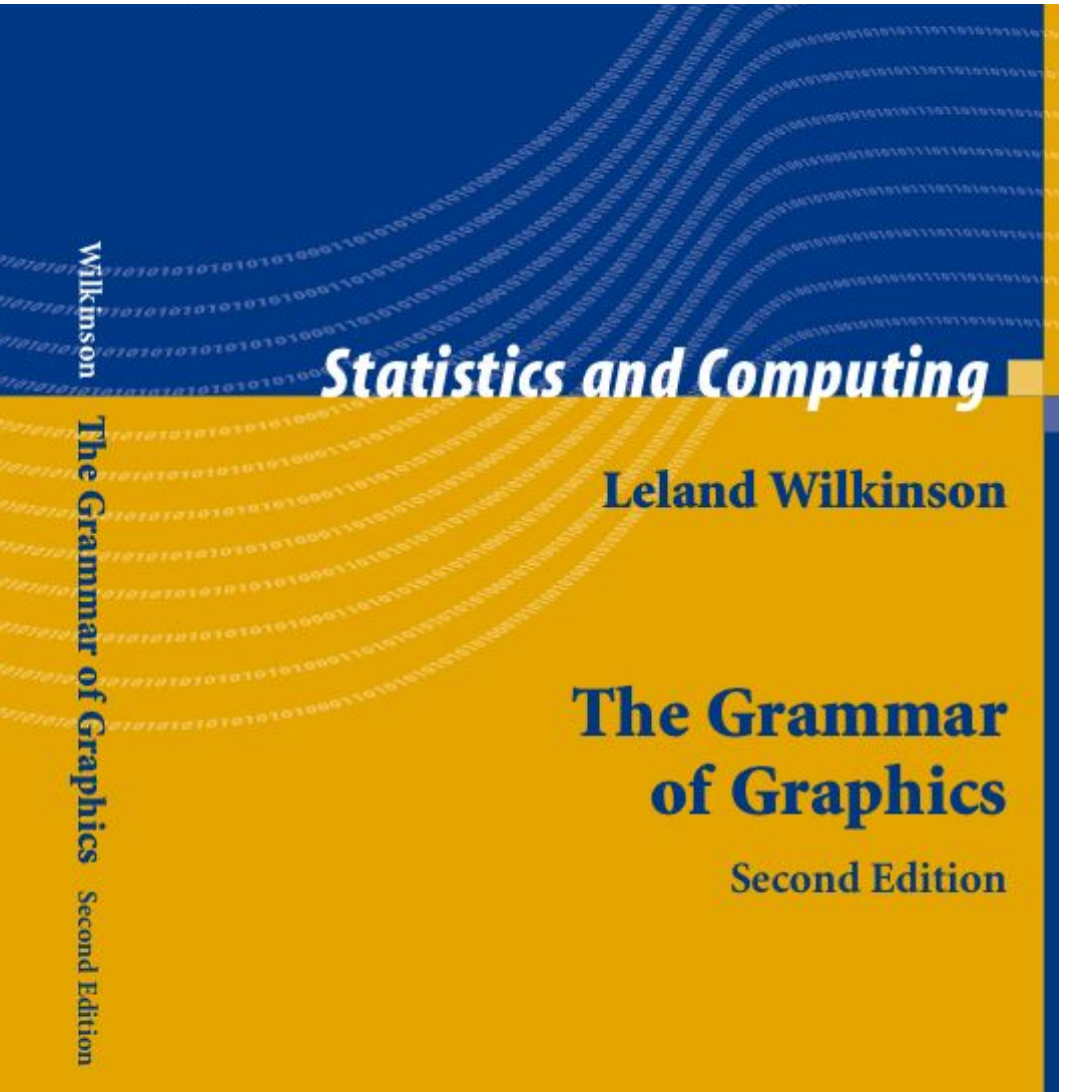
a grammar of graphics ?

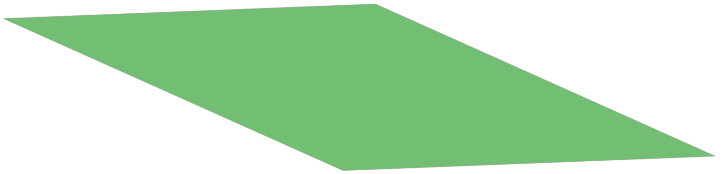
[a concept to better visually communicate quantitative data]



a grammar of graphics ?

[a concept to better visually communicate quantitative data]

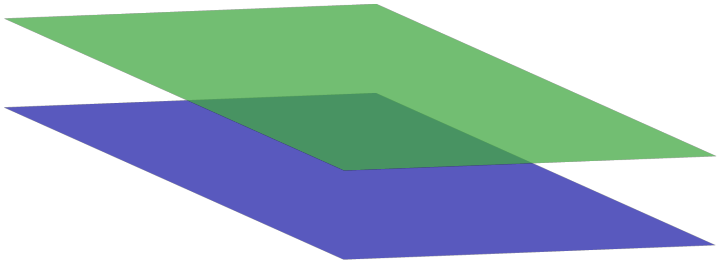
A rabid **fox** bit the friendly **dog**.



a grammar of graphics ?

[a concept to better visually communicate quantitative data]

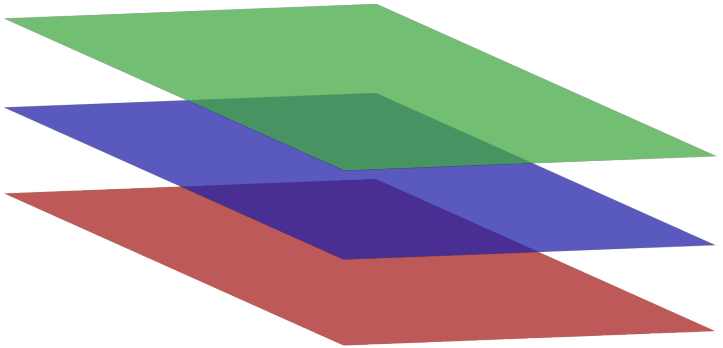
A rabid fox **bit** the friendly dog.



a grammar of graphics ?

[a concept to better visually communicate quantitative data]

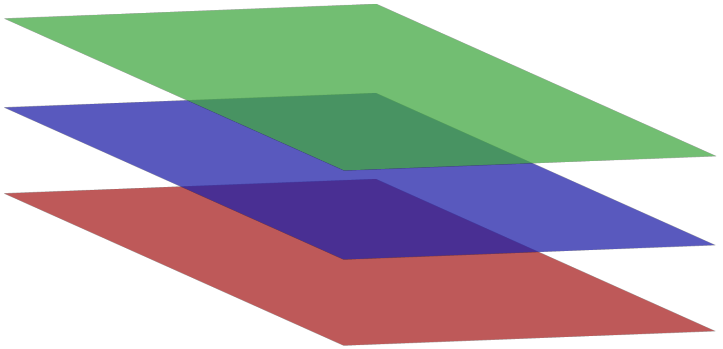
A rabid fox bit the friendly dog.



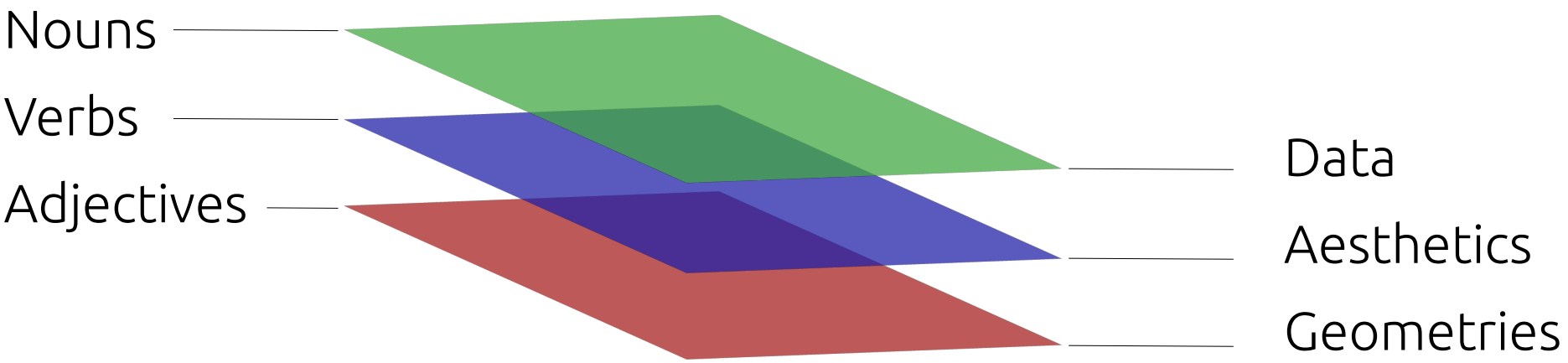
a grammar of graphics ?

[a concept to better visually communicate quantitative data]

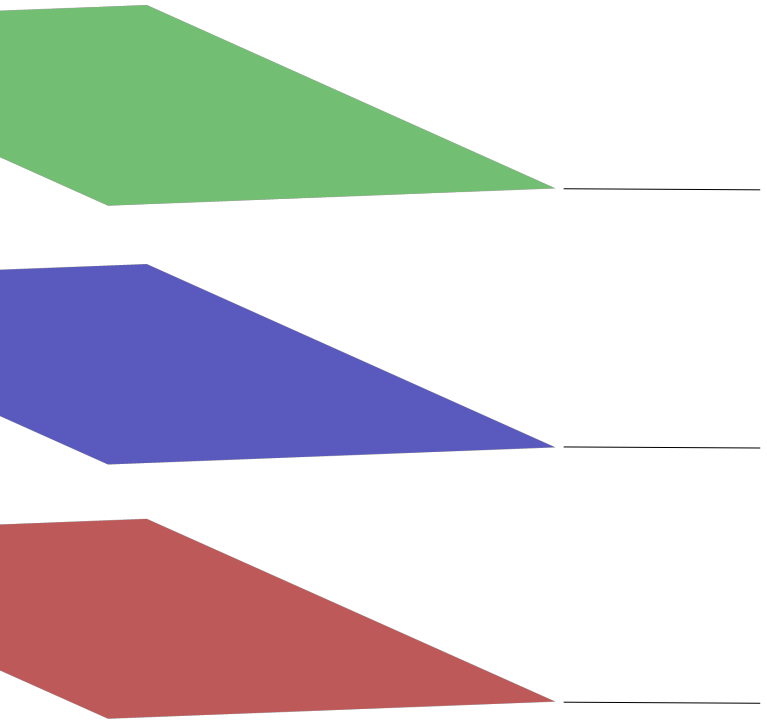
The friendly dog
was bitten by a
rabid fox.



a grammar of graphics ?



ggplot2 | elements



Data

[variables to be plotted]

Aesthetics

[scales onto which we will map our data]

Geometries

[shapes used to represent our data]

ggplot2 | msleep

We need the ggplot2 library

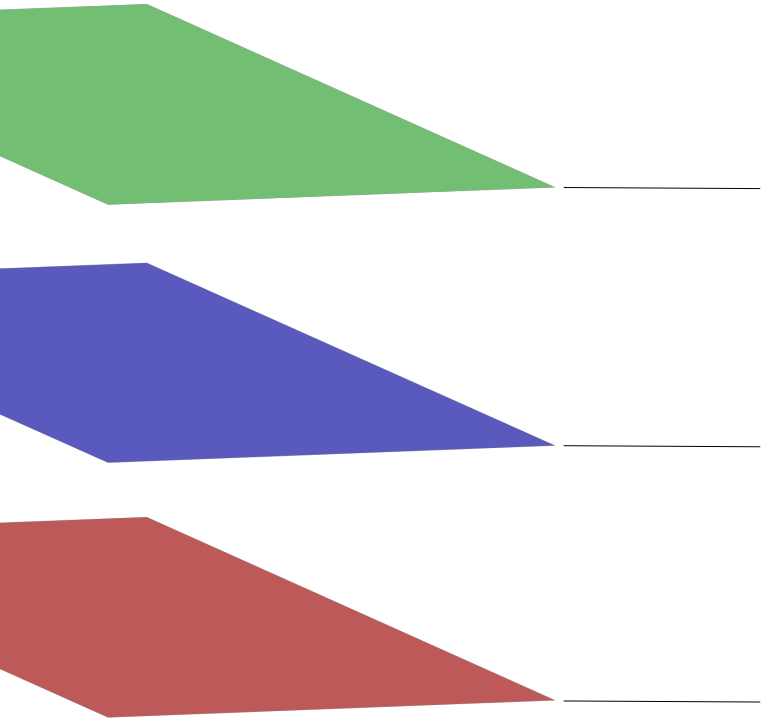
```
library(ggplot2)
```

We need some data

```
data(msleep)
```

	name	genus	vore	order	conservation	sleep_total	sleep_rem	sleep_cycle	awake	brainwt	bodywt
1	Cheetah	Acinonyx	carni	Carnivora	lc	12.1	NA	NA	11.9	NA	50.000
2	Owl monkey	Aotus	omni	Primates	<NA>	17.0	1.8	NA	7.0	0.01550	0.480
3	Mountain beaver	Aplodontia	herbi	Rodentia	nt	14.4	2.4	NA	9.6	NA	1.350
4	Greater short-tailed shrew	Blarina	omni	Soricomorpha	lc	14.9	2.3	0.1333333	9.1	0.00029	0.019
5	Cow	Bos	herbi	Artiodactyla	domesticated	4.0	0.7	0.6666667	20.0	0.42300	600.000
6	Three-toed sloth	Bradypus	herbi	Pilosa	<NA>	14.4	2.2	0.7666667	9.6	NA	3.850

ggplot2 | implementation



Data

[msleep dataset]

Aesthetics

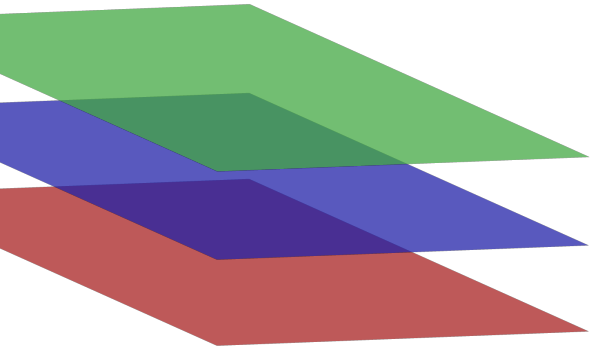
[y = sleep_rem, x=sleep_total]

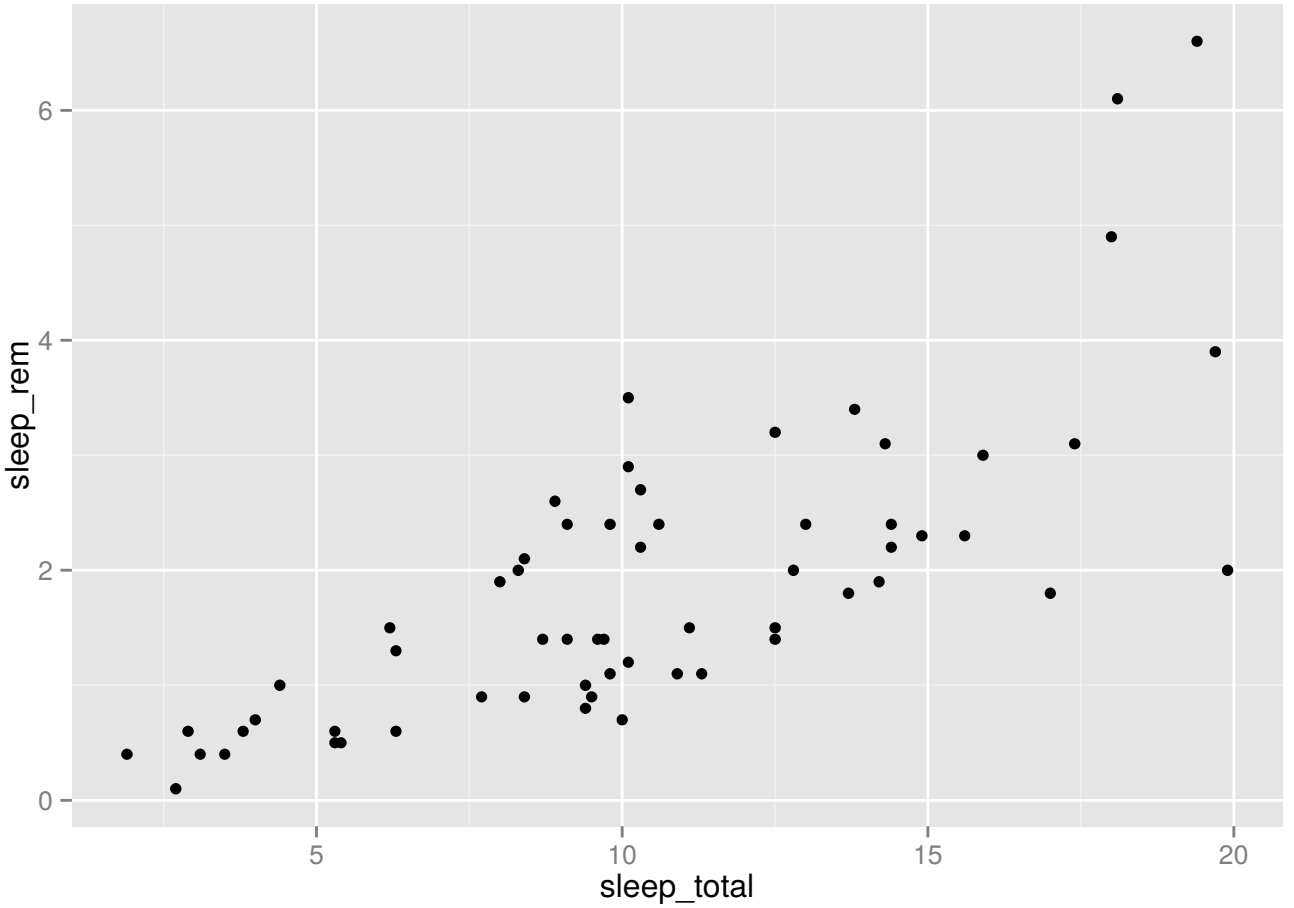
Geometries

[points]

```
ggplot(data=msleep, aes(y=sleep_rem, x=sleep_total))+
 geom_point()
```

ggplot2 | example



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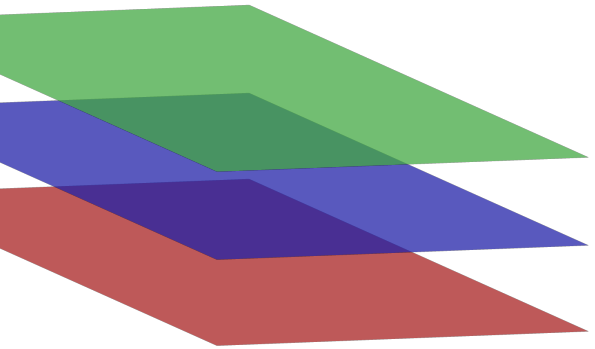
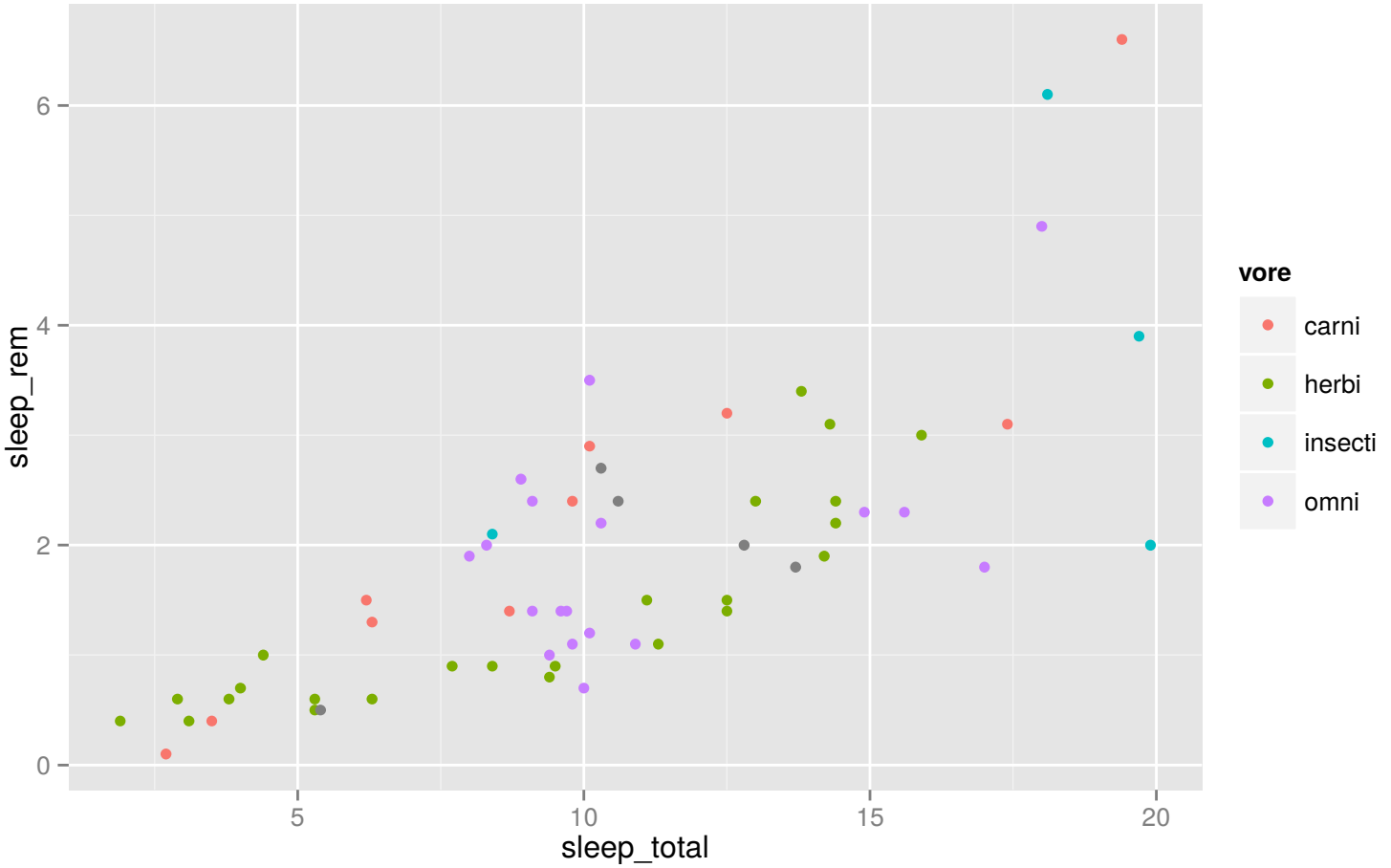
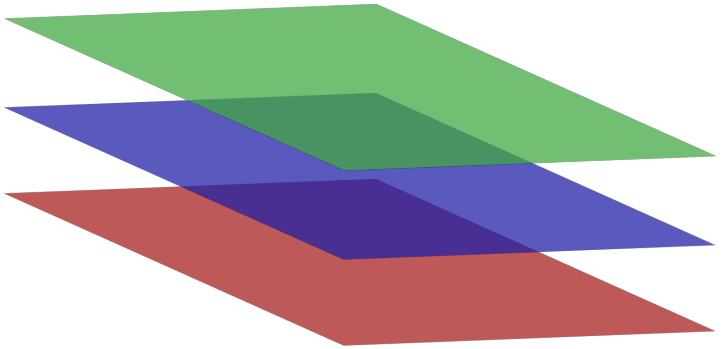
ggplot2 | example



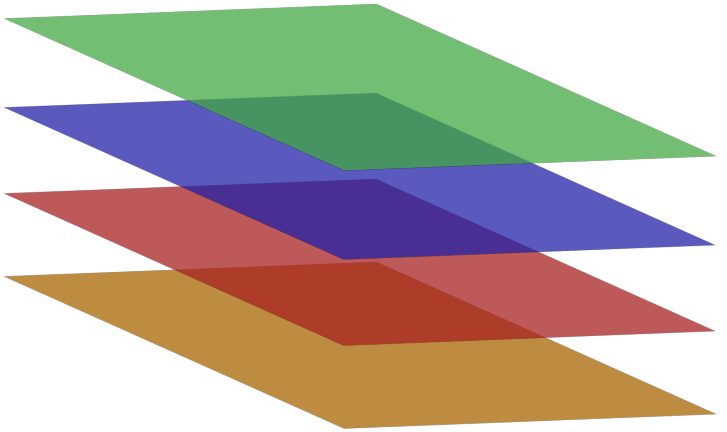



```
ggplot(data=msleep, aes(y=sleep_rem, x=sleep_total, col=vore))+
  geom_point()
```

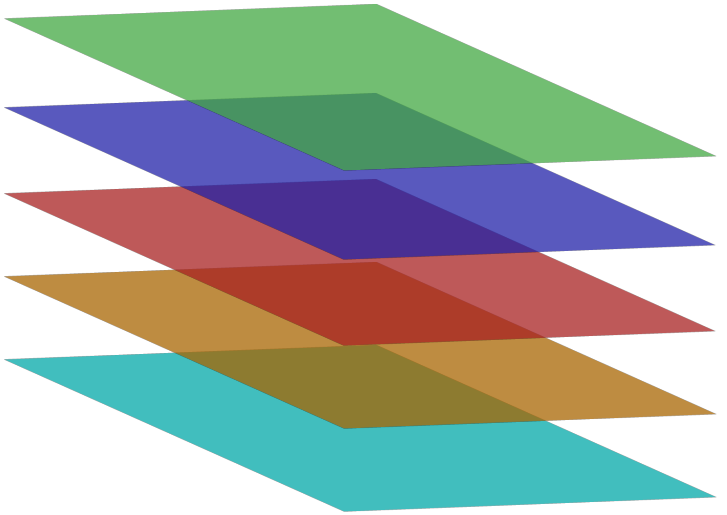
The quick brown fox jumps over the lazy dog.



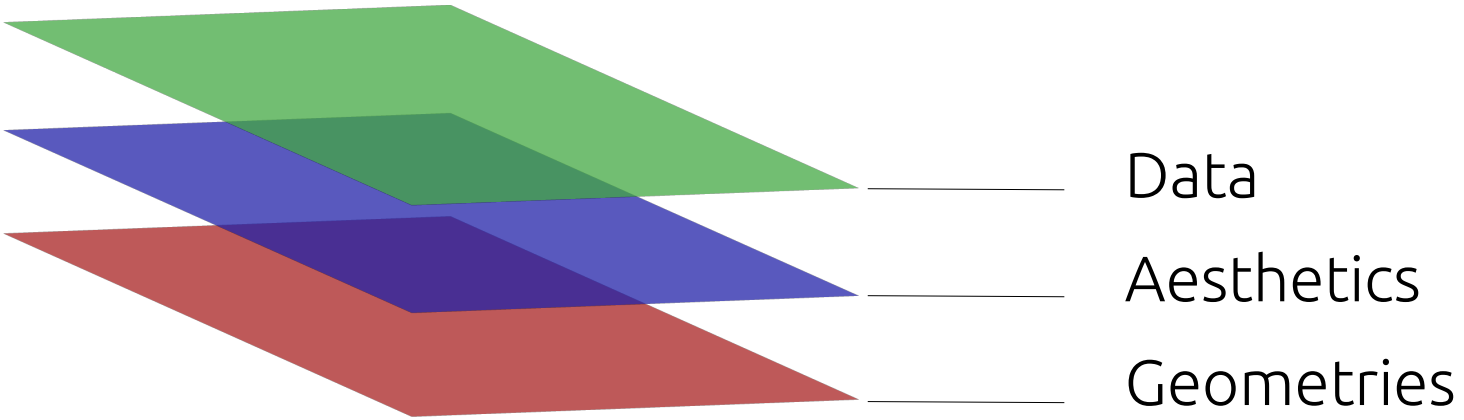
The quick brown fox jumps over the lazy dog.



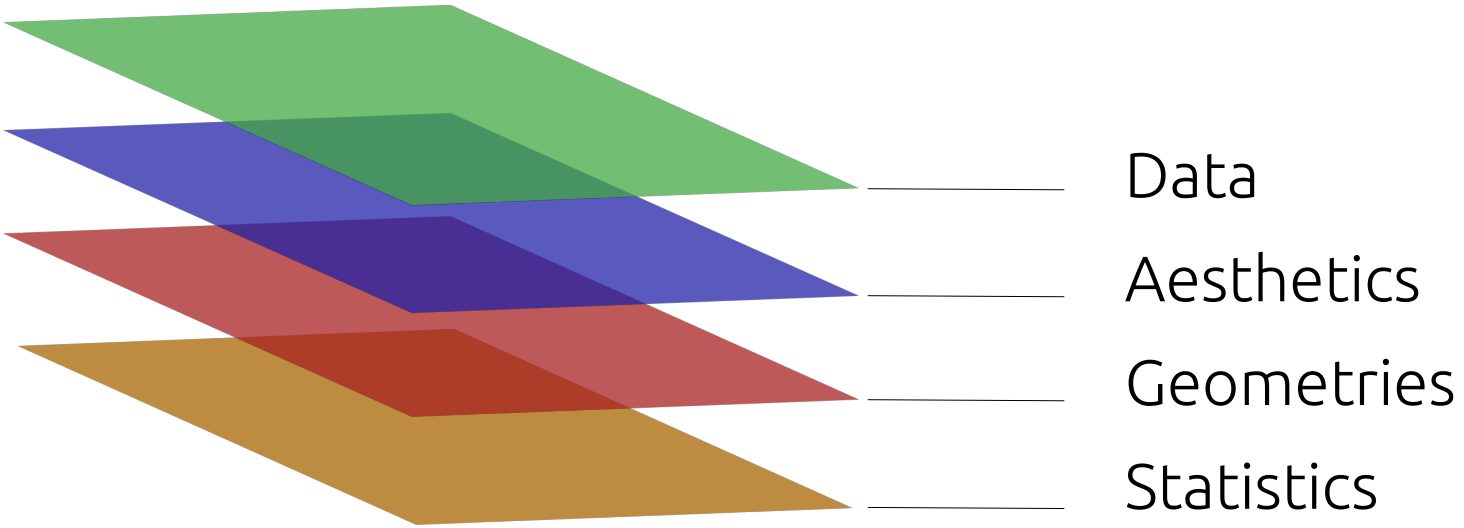
The quick brown fox jumps **over** the lazy dog.



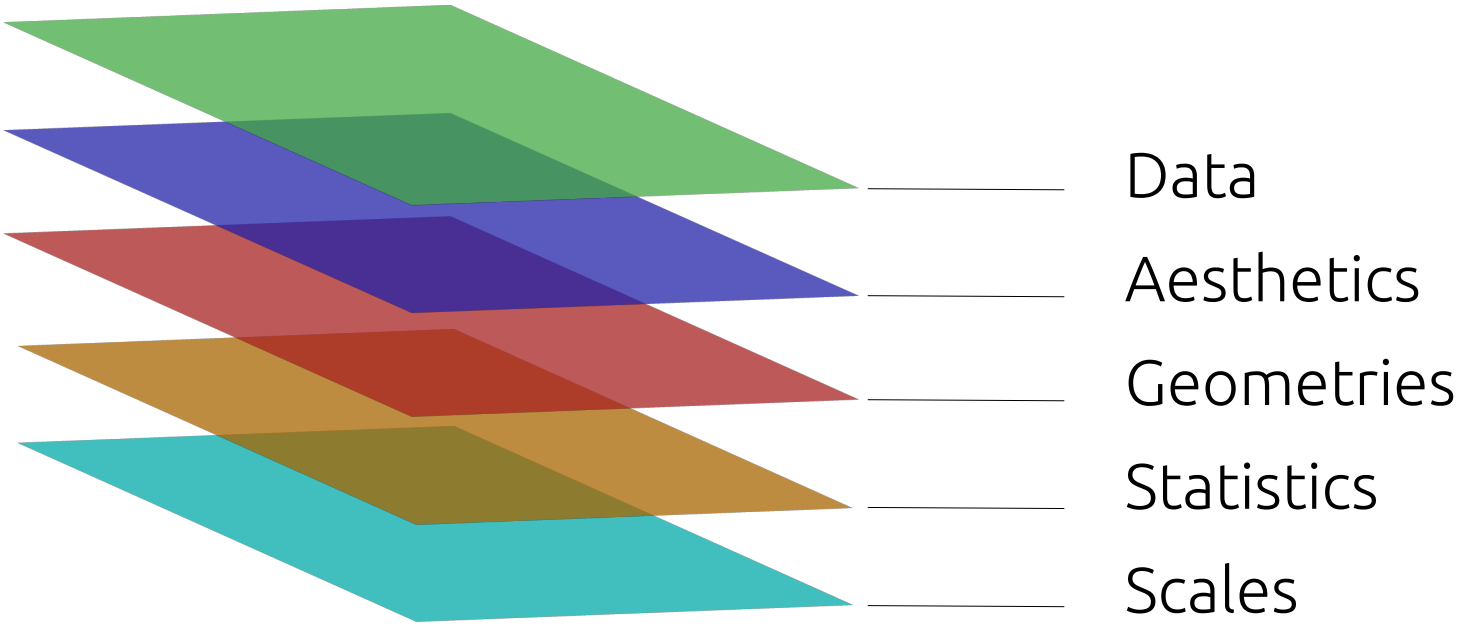
ggplot2 | elements



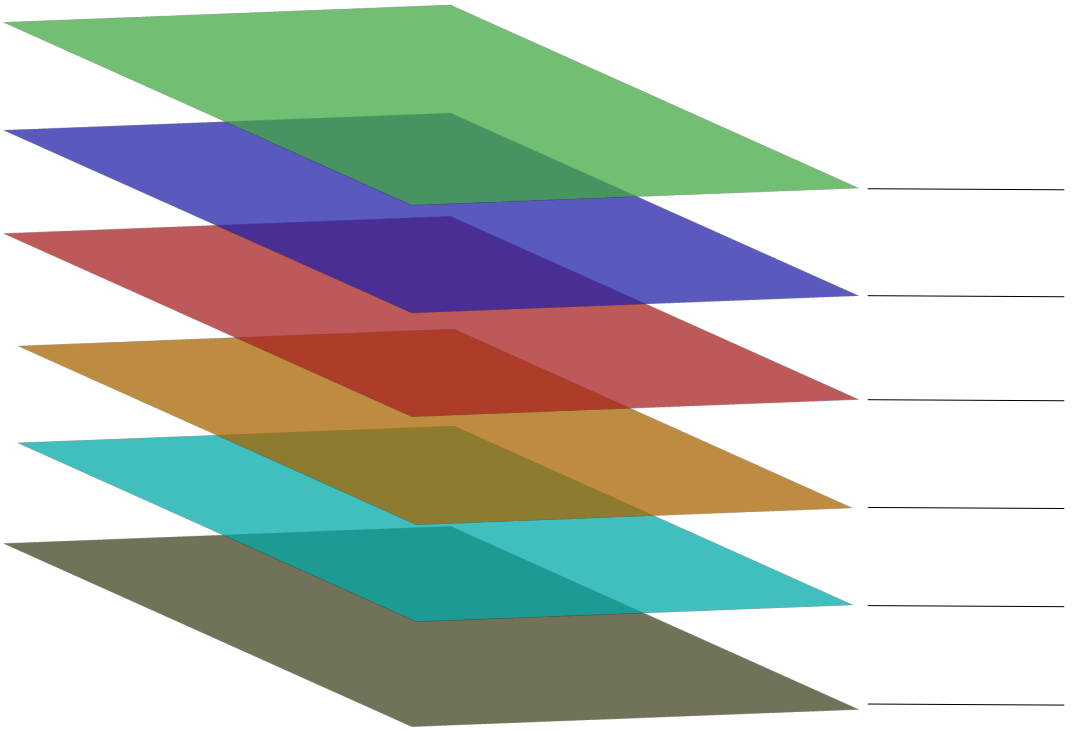
ggplot2 | other elements



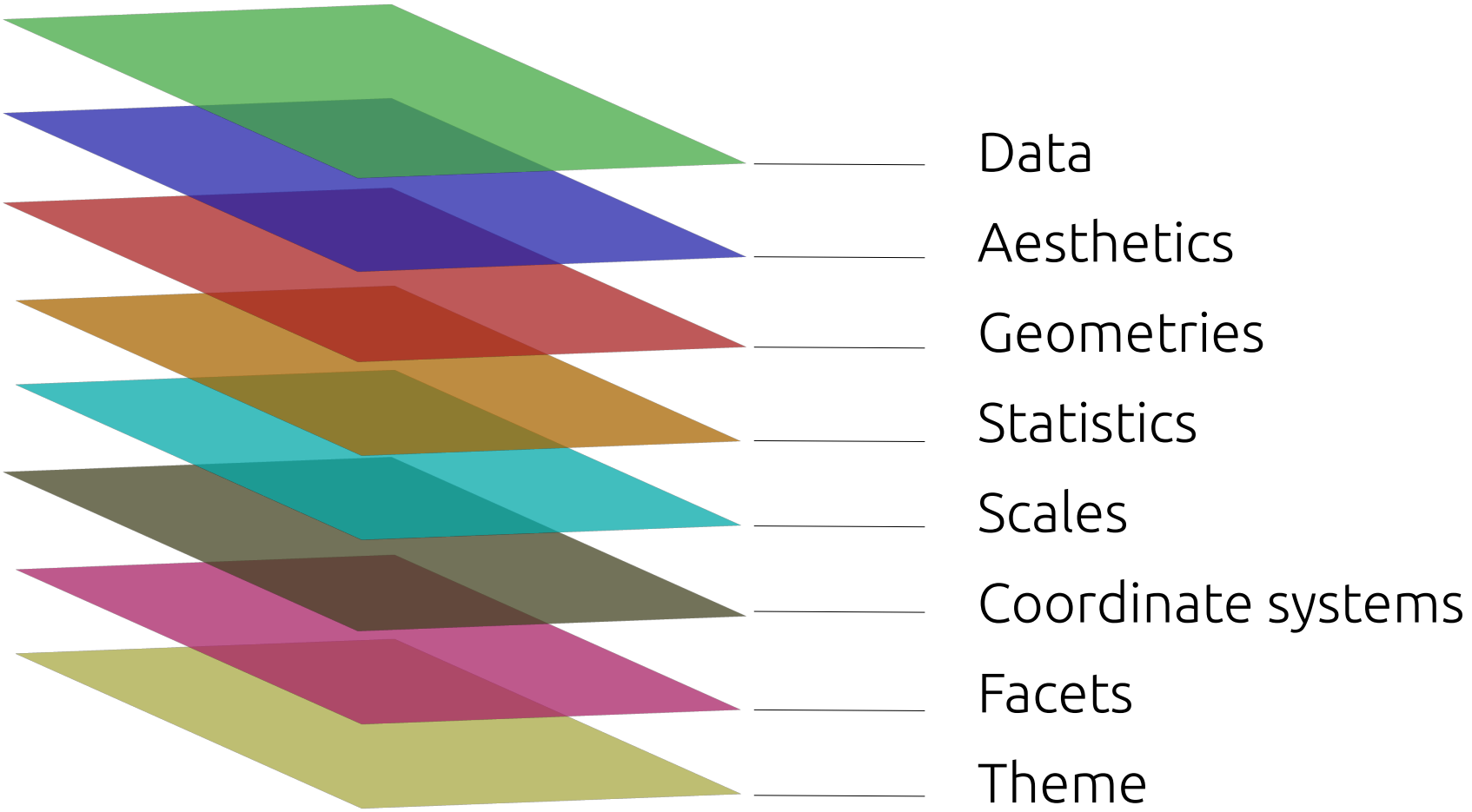
ggplot2 | other elements



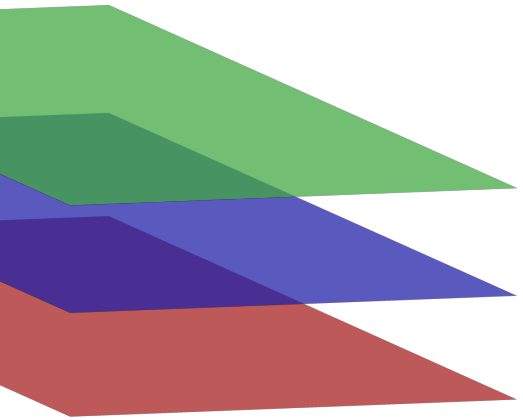
ggplot2 | other elements

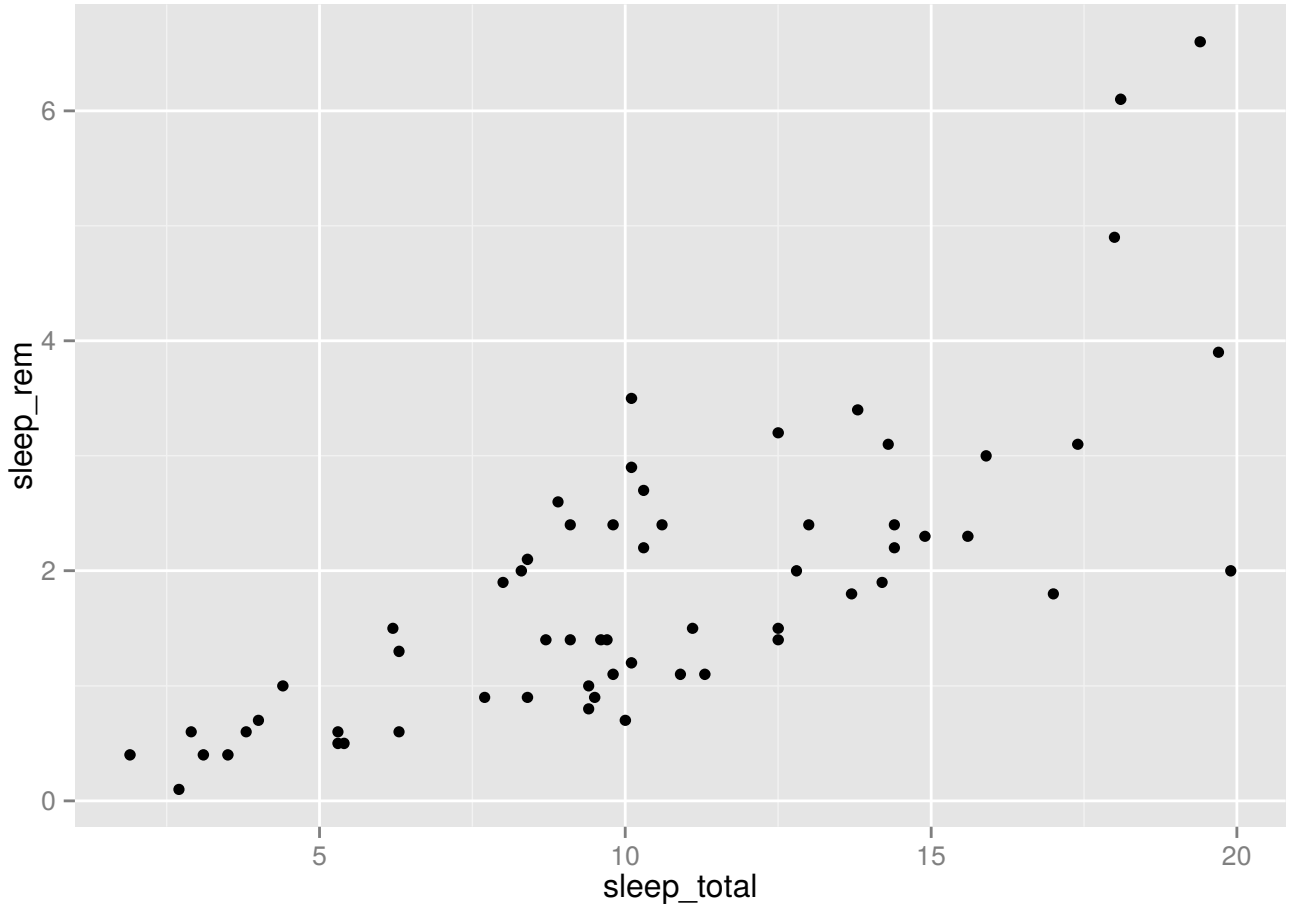


ggplot2 | so much elements !



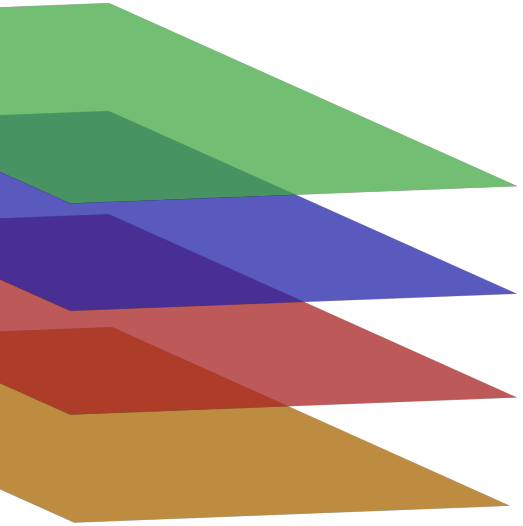
ggplot2 | example

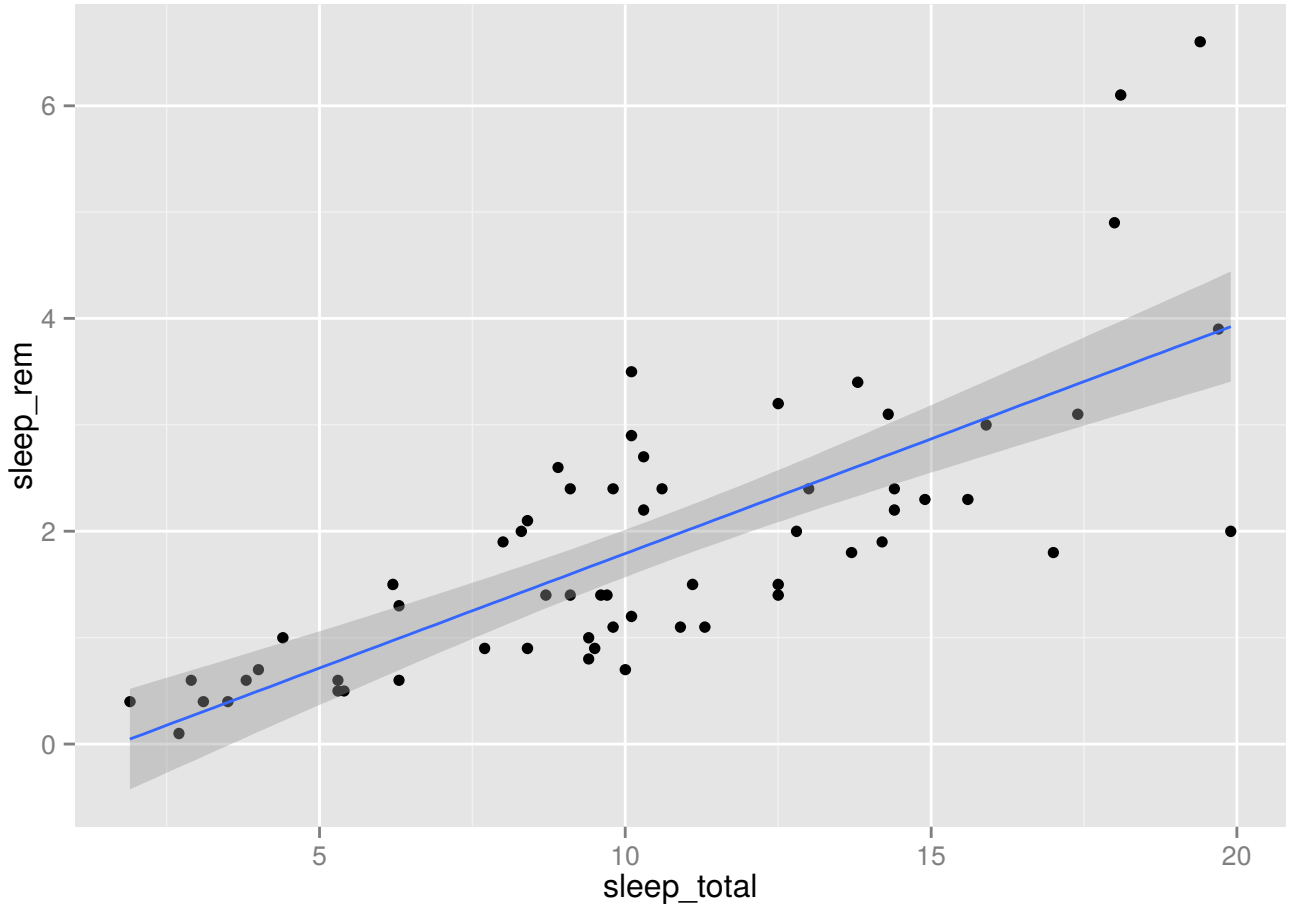





```
ggplot(data=msleep, aes(y=sleep_rem, x=sleep_total))+
  geom_point()
```

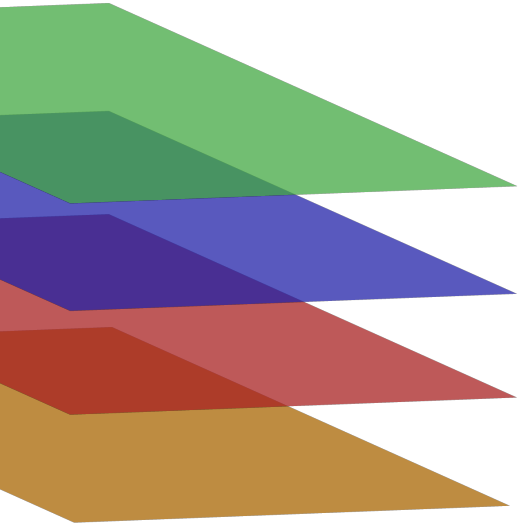
ggplot2 | example

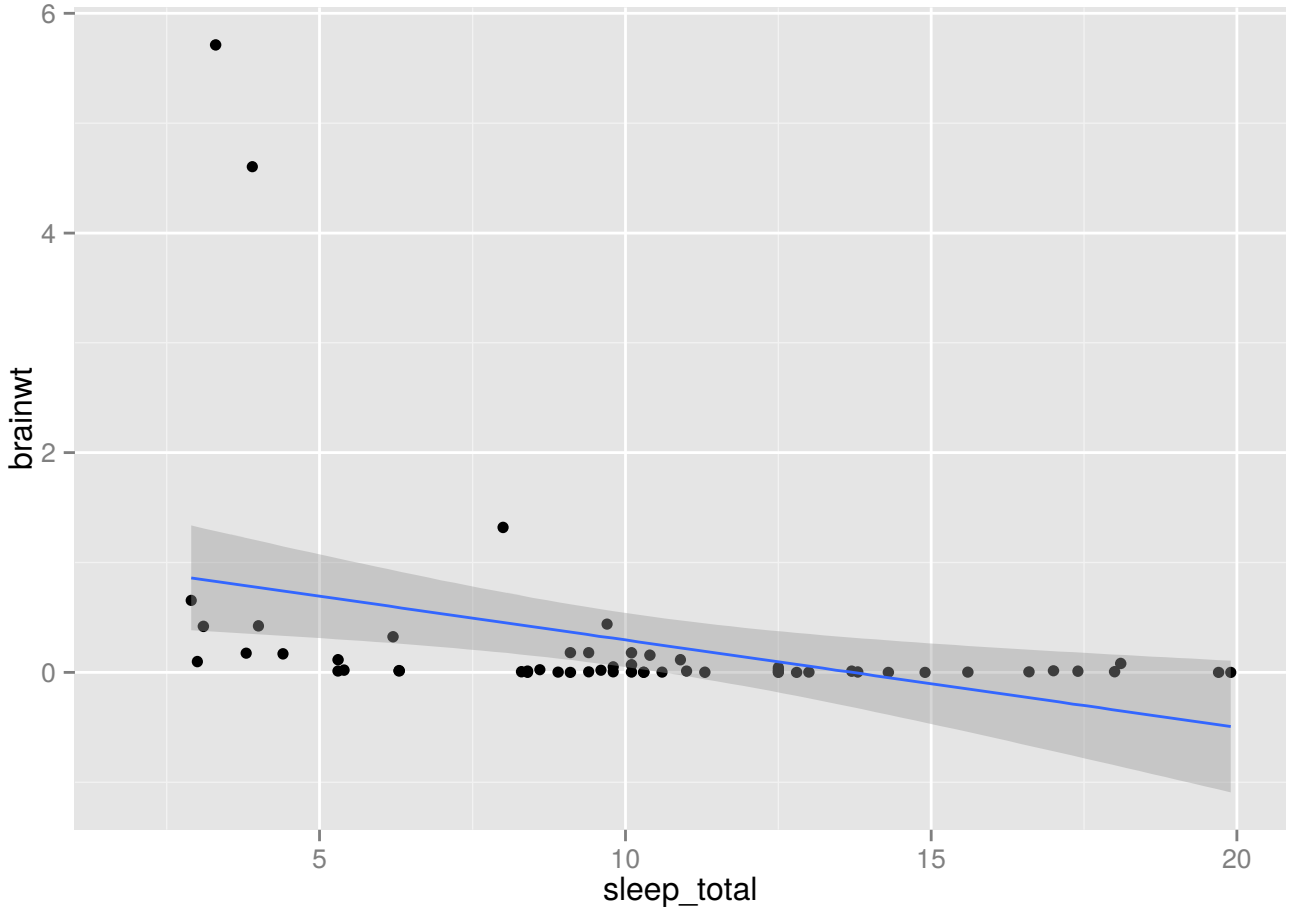





```
ggplot(data=msleep, aes(y=sleep_rem, x=sleep_total))+
  geom_point()+
  stat_smooth(method=lm)
```

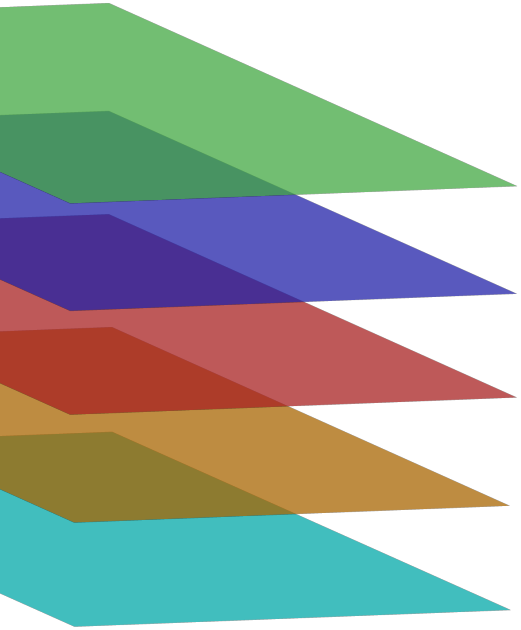
ggplot2 | example

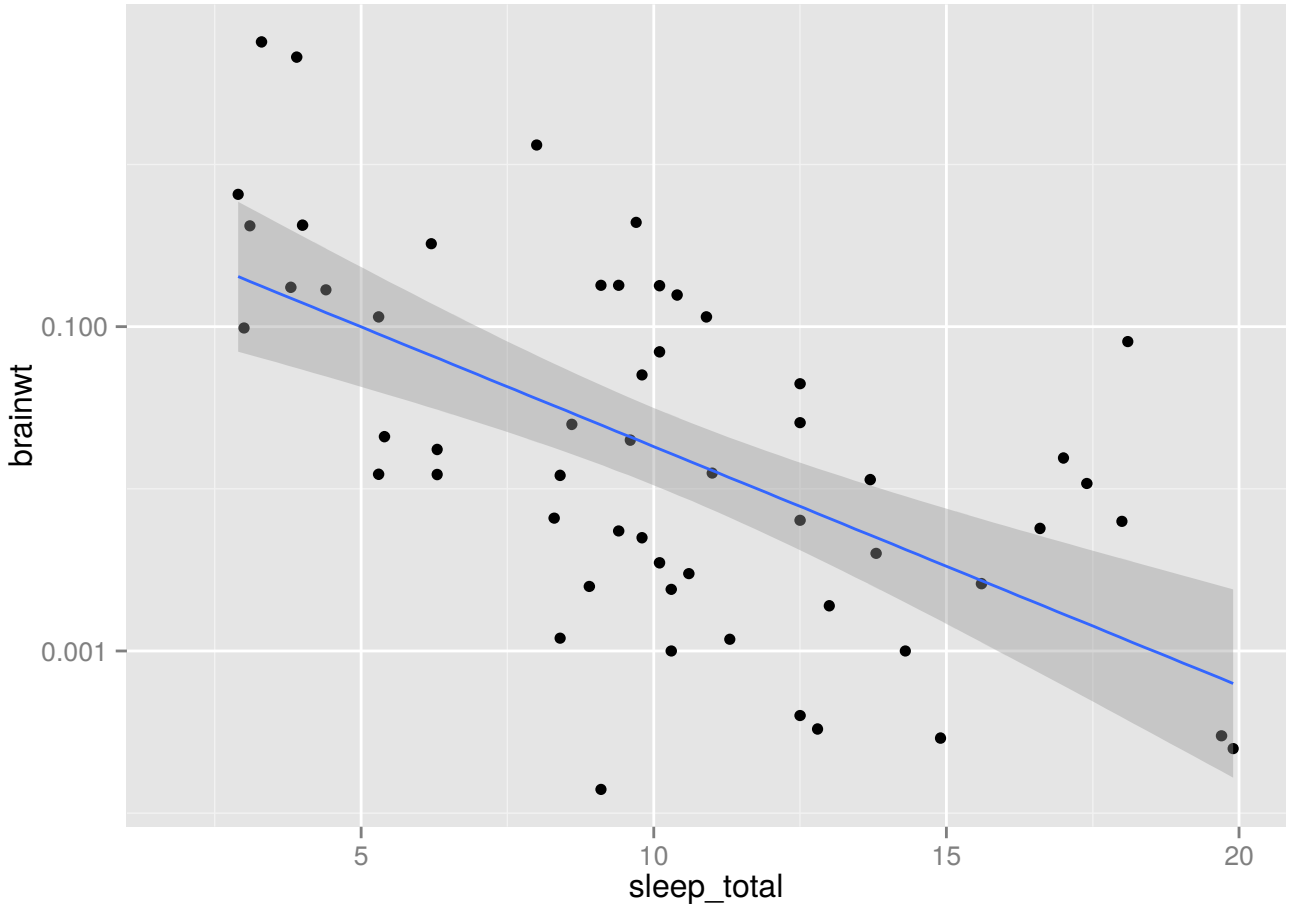





```
ggplot(data=msleep, aes(y=brainwt, x=sleep_total))+
  geom_point()+
  stat_smooth(method=lm)
```

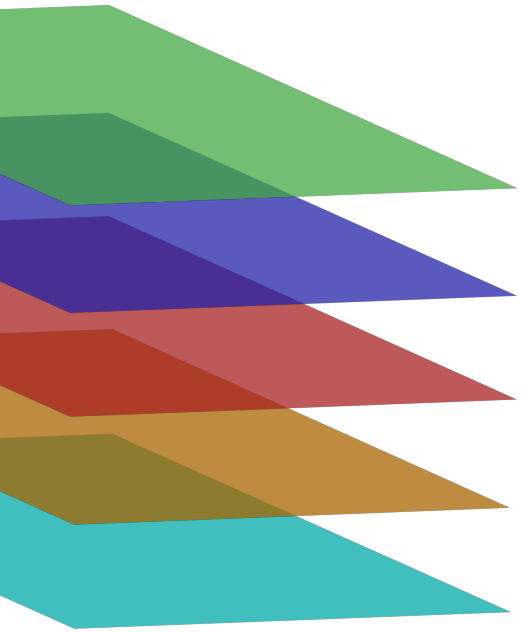
ggplot2 | example

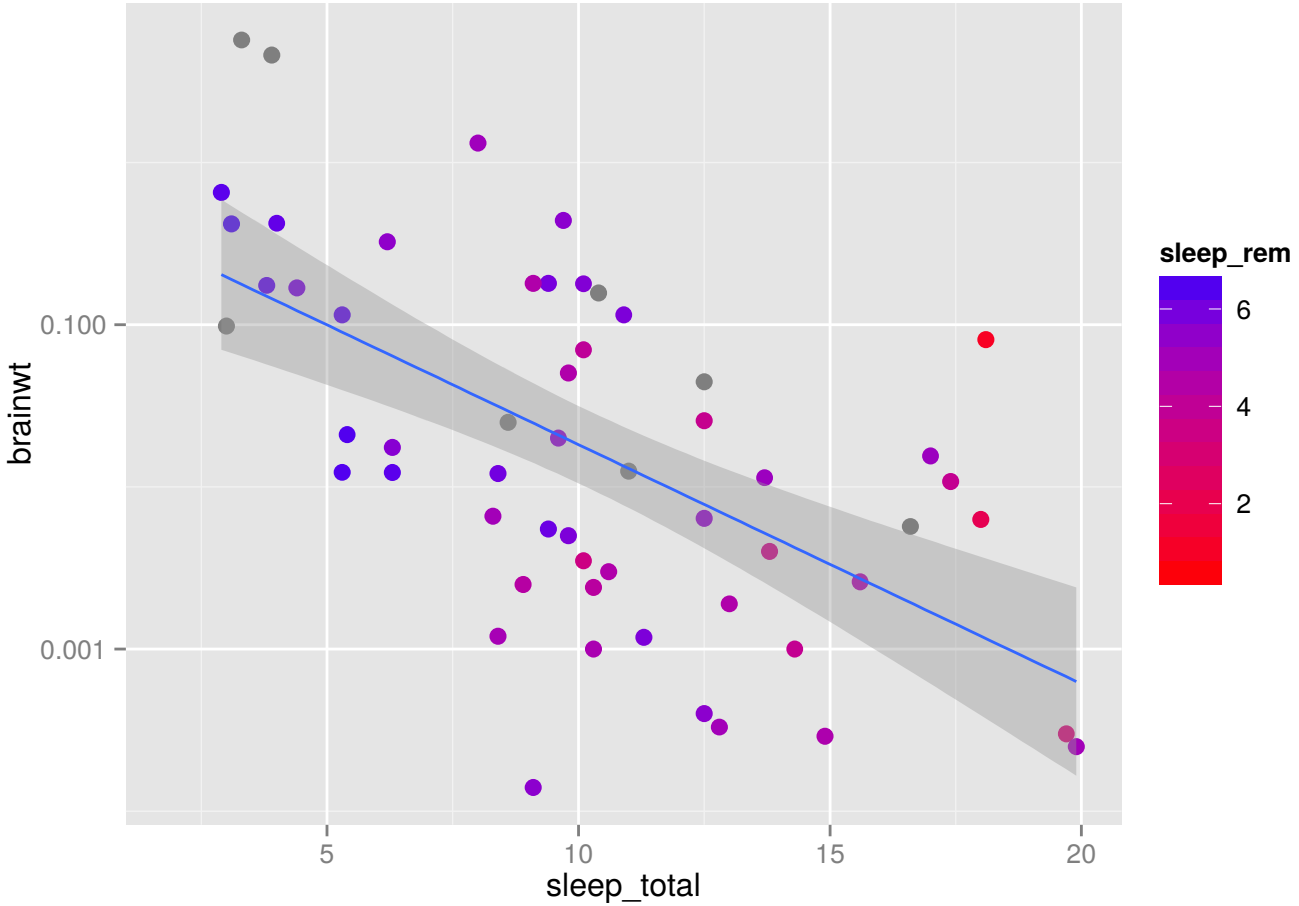





```
ggplot(data=msleep, aes(y=brainwt, x=sleep_total))+
 geom_point()+
 stat_smooth(method=lm)+
 scale_y_log10()
```

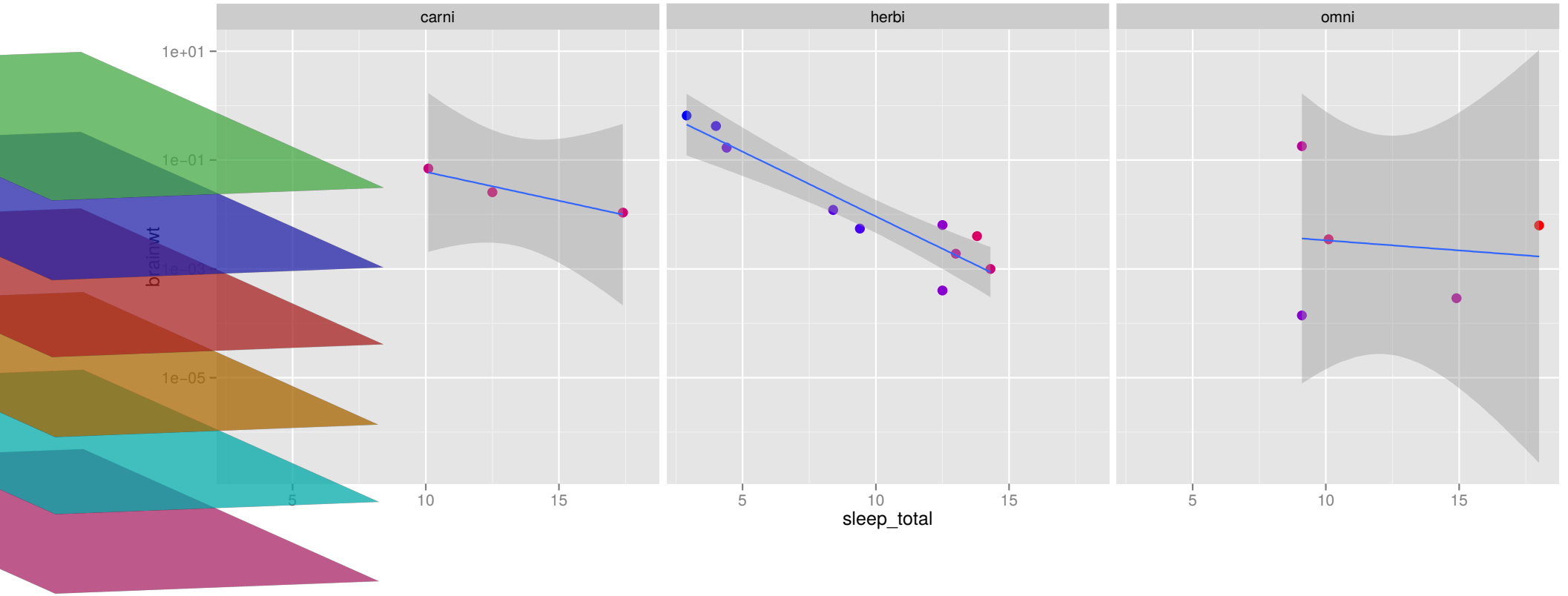
ggplot2 | example






```
ggplot(data=msleep, aes(y=brainwt, x=sleep_total, col=sleep_rem))+
 geom_point()+
 stat_smooth(method=lm)+
 scale_y_log10()+
 scale_color_gradient(low="blue", high="red")
```

ggplot2 | example




```
ggplot(data=msleep, aes(y=brainwt, x=sleep_total, col=sleep_rem))+
 geom_point()+
 stat_smooth(method=lm)+
 scale_y_log10()+
 scale_color_gradient(low="blue", high="red")
 facet_wrap(~vore)
```

ggplot2 | docs.ggplot2.org

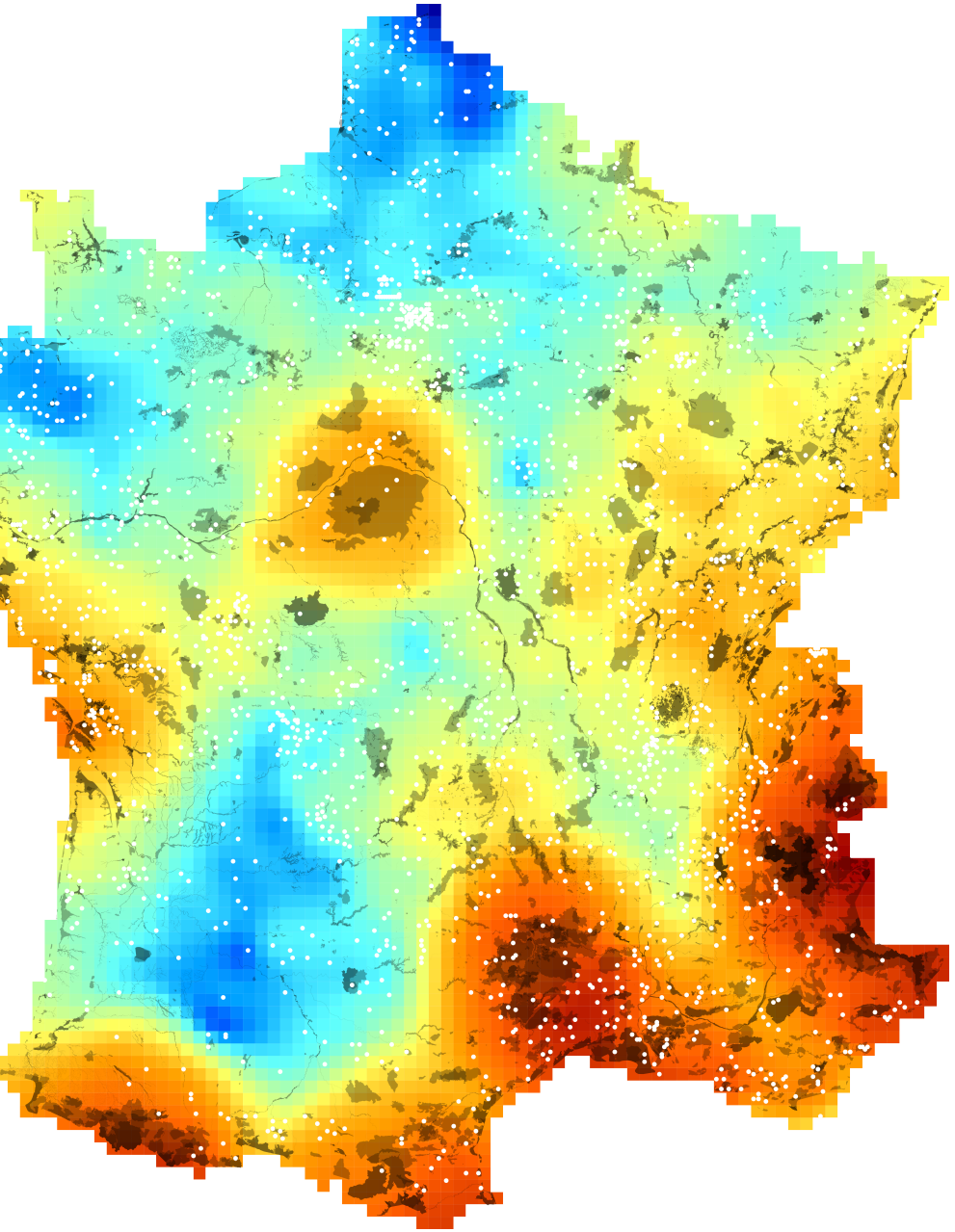
Geoms

Geoms, short for geometric objects, describe the type of plot you will produce.

- `geom_abline`
  Line specified by slope and intercept.
- `geom_area`
  Area plot.
- `geom_bar`
  Bars, rectangles with bases on x-axis
- `geom_bin2d`
  Add heatmap of 2d bin counts.
- `geom_blank`
  Blank, draws nothing.
- `geom_boxplot`
  Box and whiskers plot.
- `geom_contour`
  Display contours of a 3d surface in 2d.
- `geom_crossbar`
  Hollow bar with middle indicated by horizontal
- `geom_density`
  Display a smooth density estimate.
- `geom_density2d`
  Contours from a 2d density estimate.
- `geom_dotplot`
  Dot plot
- `geom_errorbar`
  Error bars.
- `geom_errorbarh`
  Horizontal error bars
- `geom_freqpoly`
  Frequency polygon.
- `geom_hex`

- `geom_map`
  Polygons from a reference map.
- `geom_path`
  Connect observations in original order
- `geom_point`
  Points, as for a scatterplot
- `geom_pointrange`
  An interval represented by a vertical line, with a point in the middle.
- `geom_polygon`
  Polygon, a filled path.
- `geom_quantile`
  Add quantile lines from a quantile regression.
- `geom_raster`
  High-performance rectangular tiling.
- `geom_rect`
  2d rectangles.
- `geom_ribbon`
  Ribbons, y range with continuous x values.
- `geom_rug`
  Marginal rug plots.
- `geom_segment`
  Single line segments.
- `geom_smooth`
  Add a smoothed conditional mean.
- `geom_step`
  Connect observations by stairs.
- `geom_text`
  Textual annotations.
- `geom_tile`
  Tile plane with rectangles.
- `geom_violin`
  Violin plot.

ggplot2



is beautiful

is powerful

is easy

is widely used

ggplot2

is limited (no 3d plots)

is slower (than lattice)

is not easy

ggplot2 | in practice

A short **workshop** (1/2day)
current September

pierre.gauzere@gmail.com