Emulate the `persp()` plot and `filled.contour()` plot on **gridGraphics**

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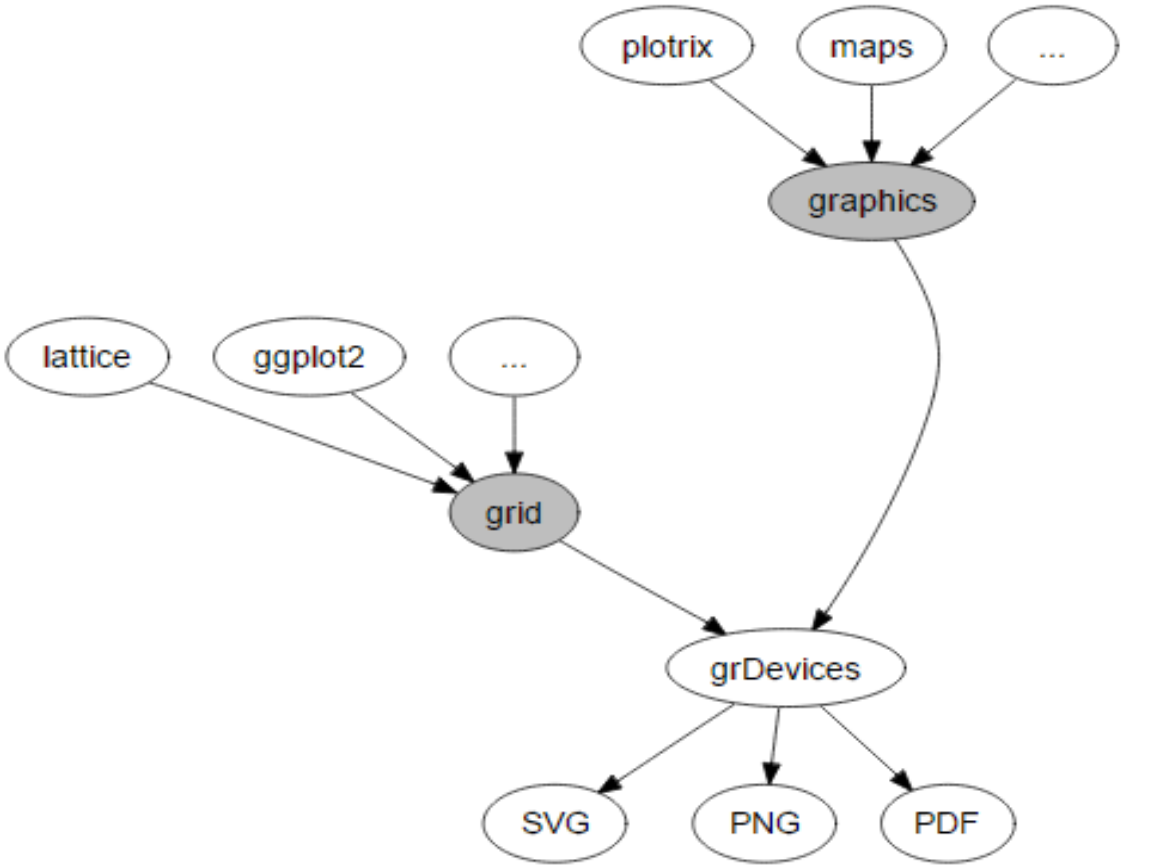
Introduction

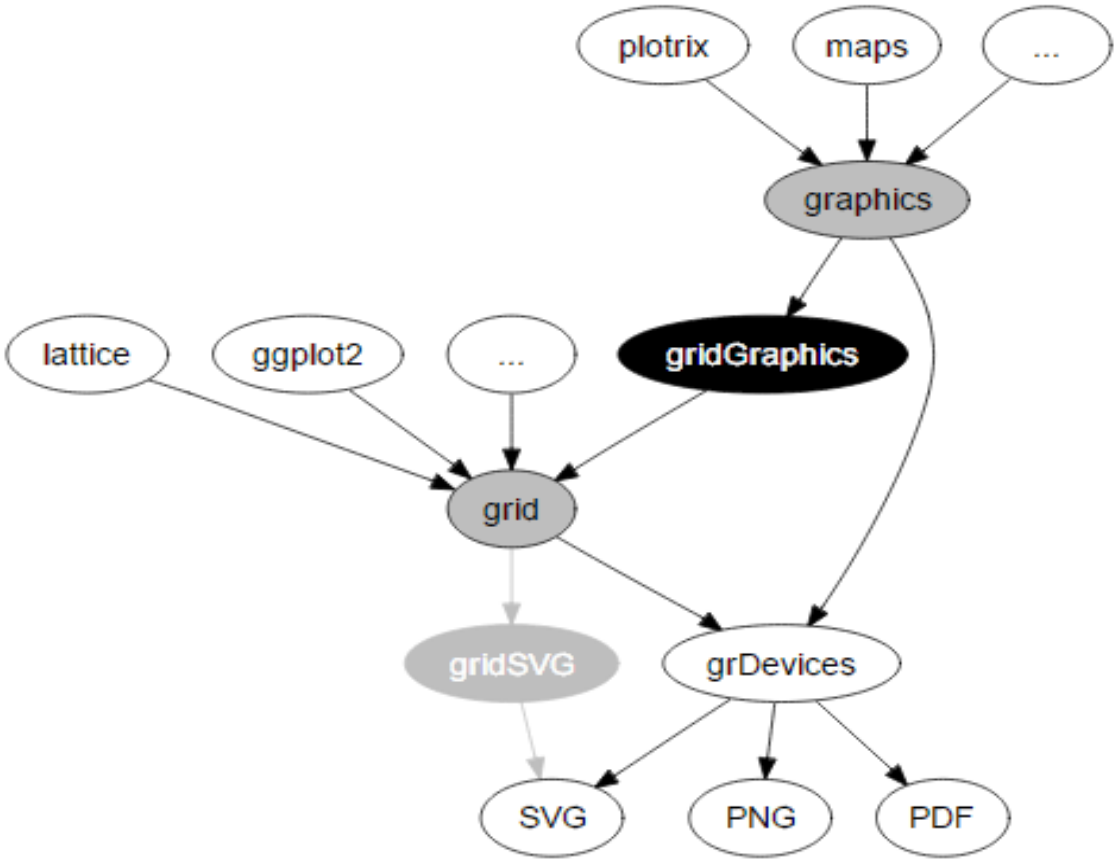
Introduction

What is **graphics** and what is **grid** ?



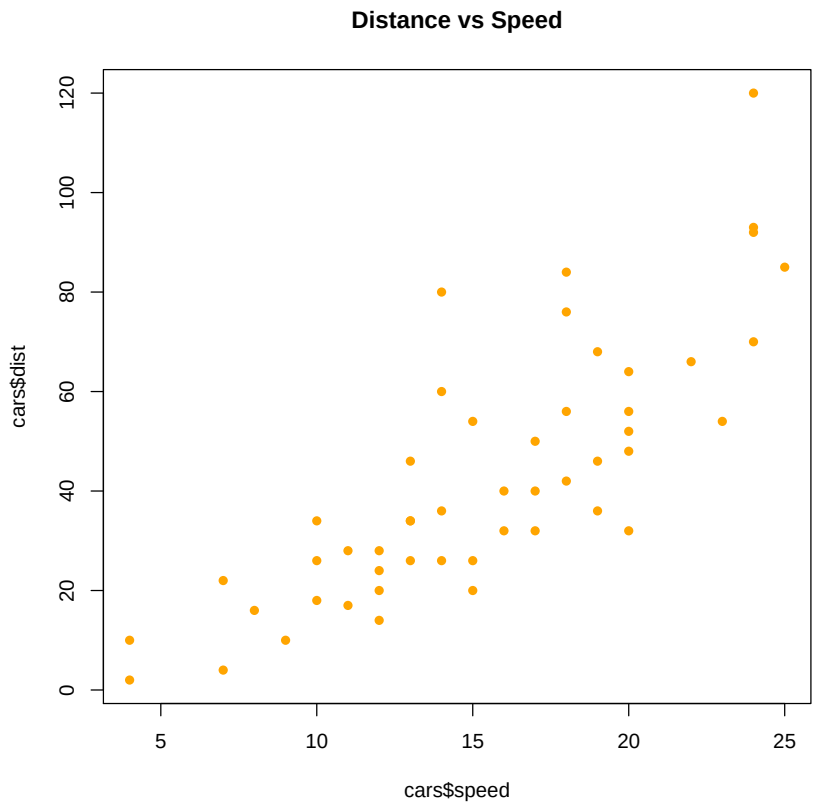
Introduction

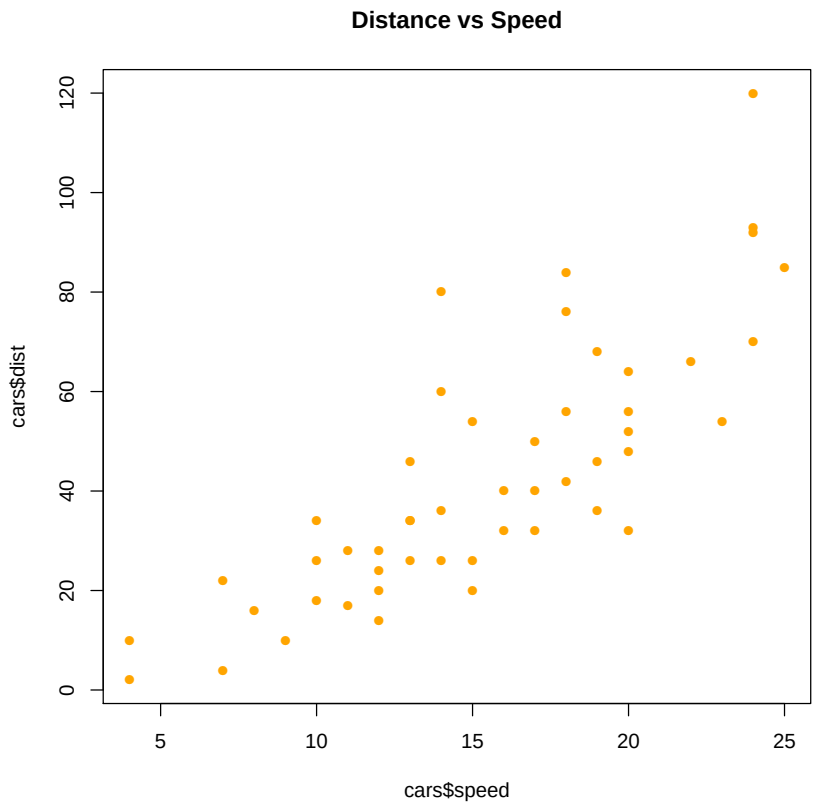
What is **gridGraphics**?



Example

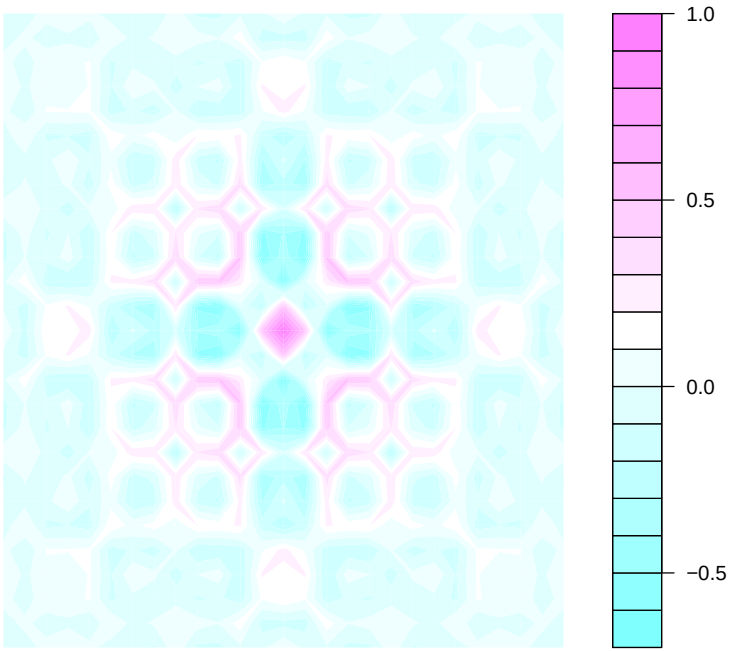
```
> plot(cars$dist ~ cars$speed, pch = 16,
+      col = 'orange', main = 'Distance vs Speed')
> library(gridGraphics)
> grid.echo()
```

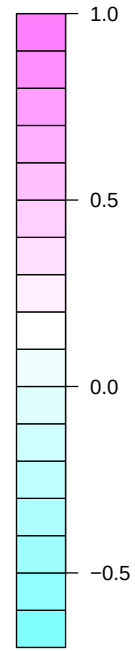




The problem

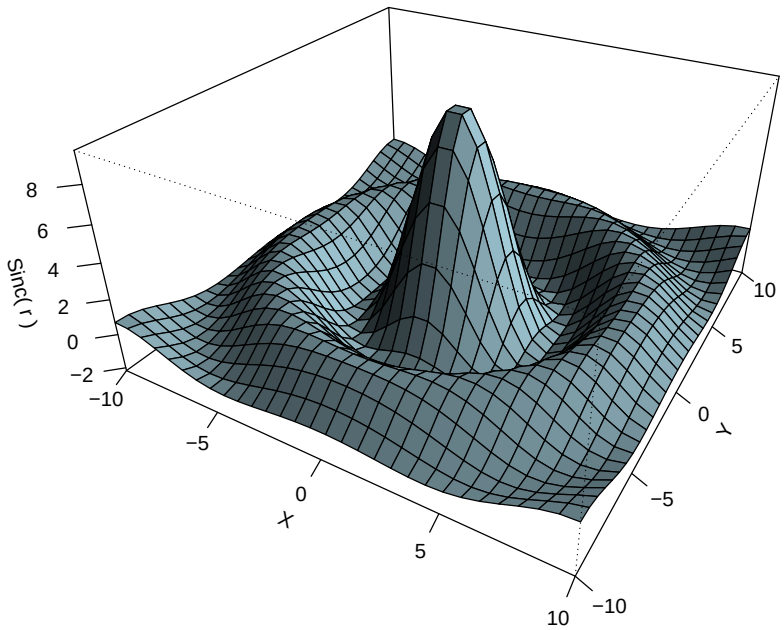
```
> Persian_Rug_Art() ##filled.contour()
> grid.echo()
```





The problem

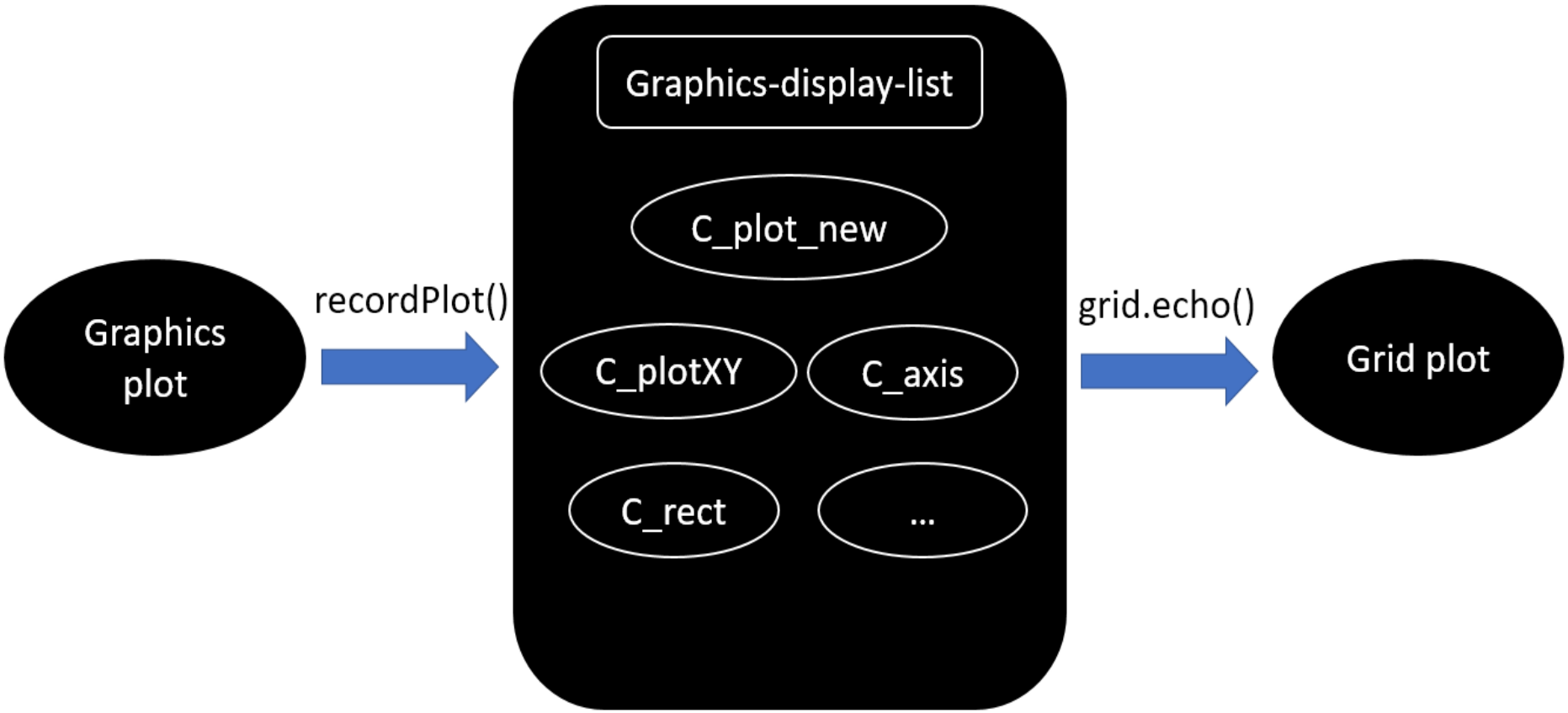
```
> Sinc_Curve() ##persp()
> grid.echo()
```



The graphics engine display list

The graphics engine display list

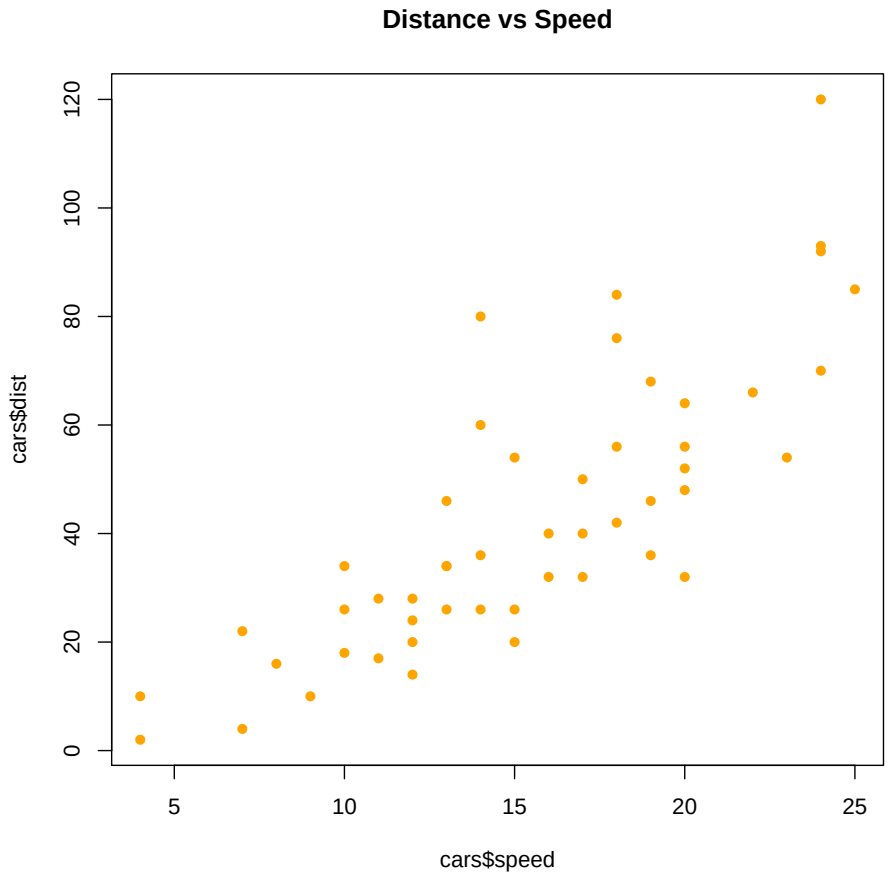
How does **gridGraphics** works?



The graphics engine display list

```
x <- recordPlot()
unlist(lapply(x[[1]], function(y) y[[2]][[1]]$name))
```

```
"C_plot_new"
"palette2"
"C_plot_window"
"C_plotXY"
"C_axis"
"C_axis"
"C_box"
"C_title"
```



C_plot_new from **graphics**

The **C** code

```
SEXP C_plot_new(SEXP call, SEXP op, SEXP args, SEXP rho)
{
    ...
    dd = GNewPlot(GRecording(call, dd));
    ...
    GScale(0.0, 1.0, 1, dd);
    GScale(0.0, 1.0, 2, dd);
    GMapWin2Fig(dd);
    GSetState(1, dd);
    ...
}
```

Structure of the C code

Structure of the **C** code (pointers)

The **C** code

```
static int LimitCheck(double *lim, double *c, double *s){
  ...
  *s = 0.5 * fabs(lim[1] - lim[0]);
  *c = 0.5 * (lim[1] + lim[0]);
  ...
}
LimitCheck(REAL(xlim), &xc, &xs)
```

The **R** code

```
LimitCheck <- function(lim){
    ...
    s <- 0.5 * abs(lim[2] - lim[1])
    c <- 0.5 * (lim[2] + lim[1])
    c(s, c)
}
xs <- LimitCheck(xr)[1]; xc <- LimitCheck(xr)[2]
```

How much **C** codes?

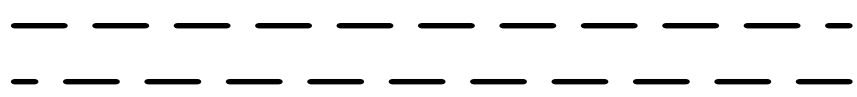
Copy or not copy?

"Copy" or not "copy"?

Why "copy"?

1. To make sure the **graphics**-plot is identical to the **grid**-plot (accuracy)

```
segments(x0 = 0, 0.5, x1 = 1, 0.5, lty = 1331, lwd = 5)
segments(x0 = 1, 0.5, x1 = 0, 0.5, lty = 1331, lwd = 5)
```



Why not just "copy"?

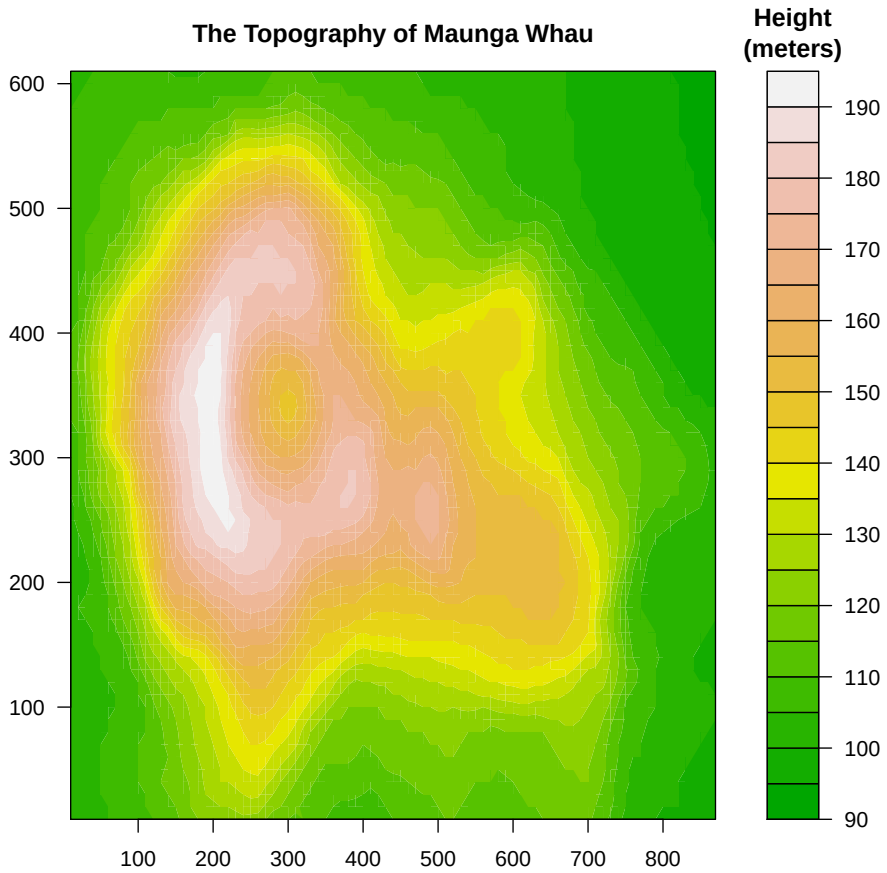
1. Speed (efficiency)

Why not just “copy”?

```
volcano_filled.contour()
xx <- recordPlot()
info <- xx[[1]][[12]][[2]]

dim(info[[4]])
[1] 87 61

length(info[[5]])
[1] 22
```



There are at most (87 - 1) * (61 - 1) * (22 - 1) = 108360 polygons.

Why not just “copy”?

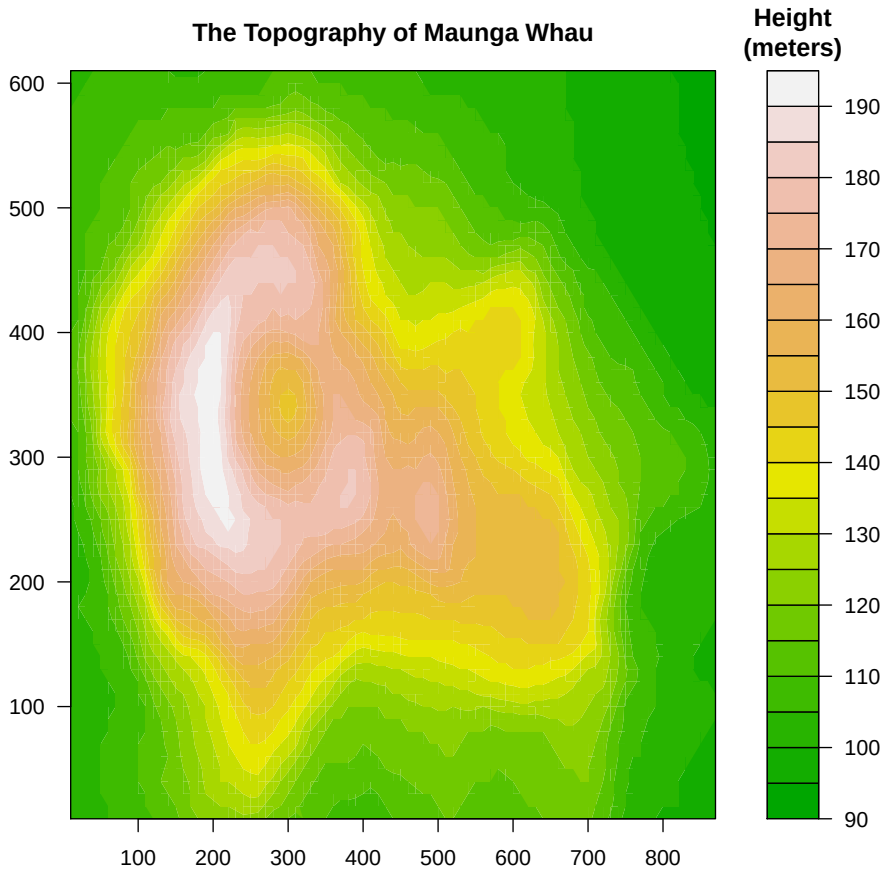
```
volcano_filled.contour()


## For loop
system.time(grid.echo())

# user system elapsed
# 10.03 0.23 10.32


## vectorization
system.time(grid.echo())

# user system elapsed
# 1.28 0.53 1.82
```



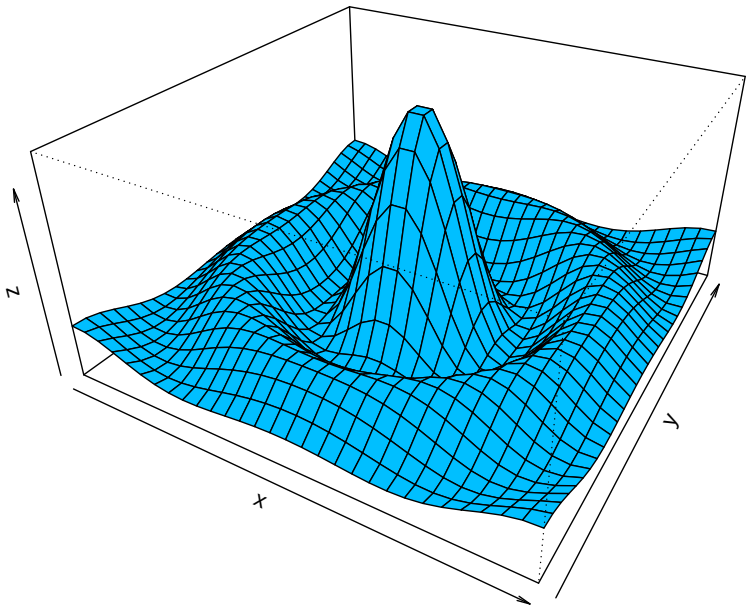
Testing

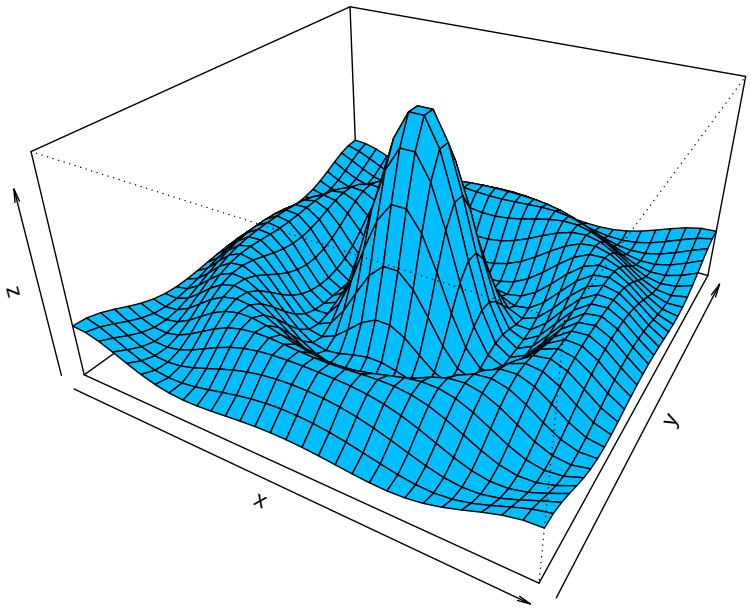
Why doing the testing by using a software?

- To ensure the plot drawn by **graphics** is identical to the plot drawn by **grid**
- Using our eyes to check the identity will be wasting time and not reliable

Any difference?

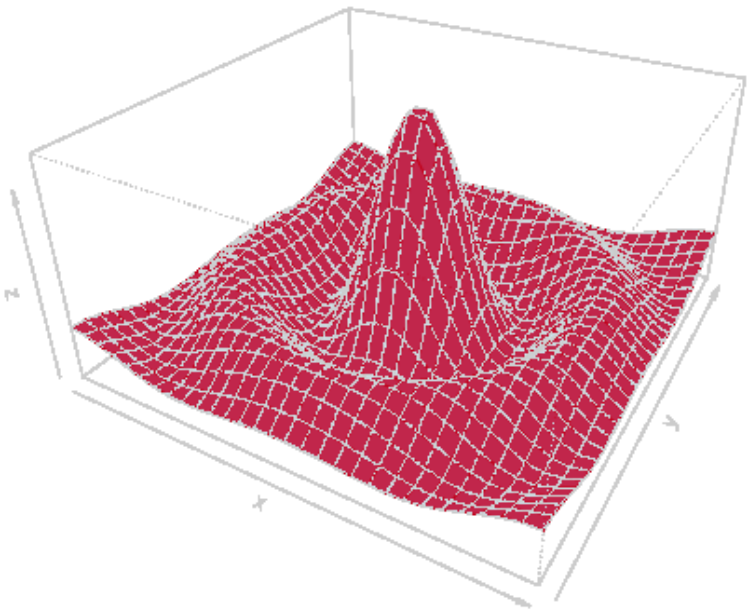
```
## left plot
Sinc_Curve(col = rgb(red = 0, blue = 191, green = 255, ...))
## right plot
Sinc_Curve(col = rgb(red = 0, blue = 190, green = 255, ...))
```





Answers

```
cmd <- 'compare diff_1.pdf
        diff_2.pdf
        diff_out.pdf'
system(cmd)
```

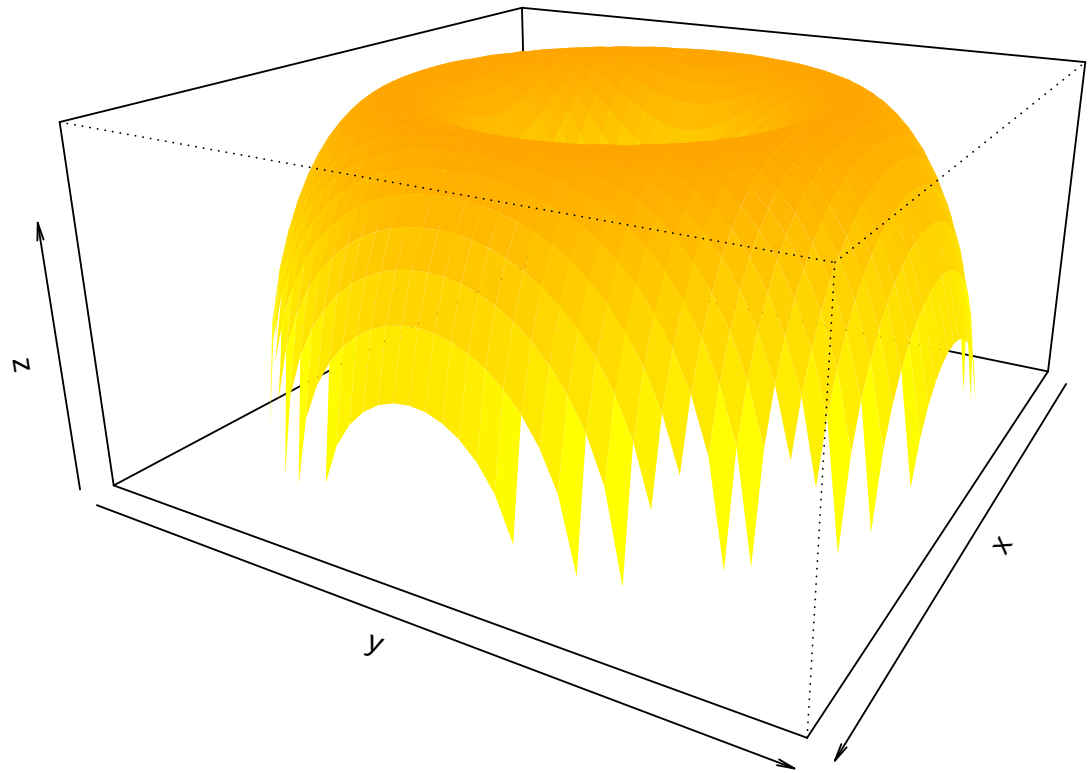


Difference dected by using the software* **ImageMagick

Final solution

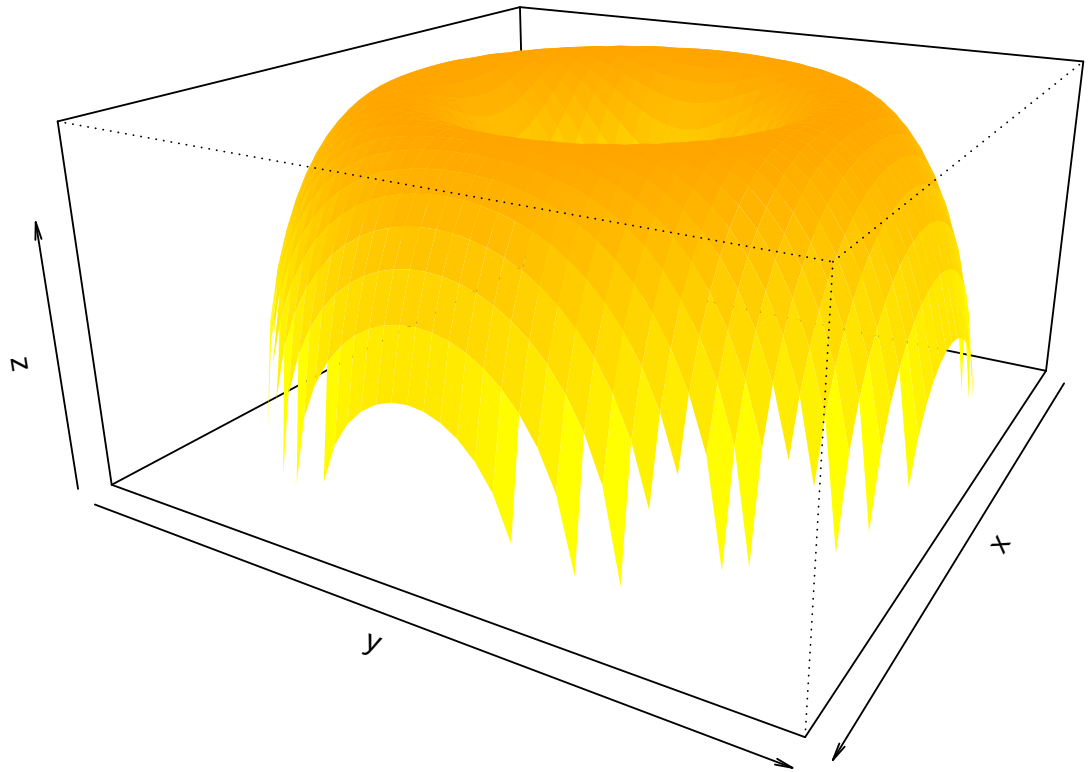
Final solution

```
> Torus()
```



Final solution

```
> grid.echo()
```

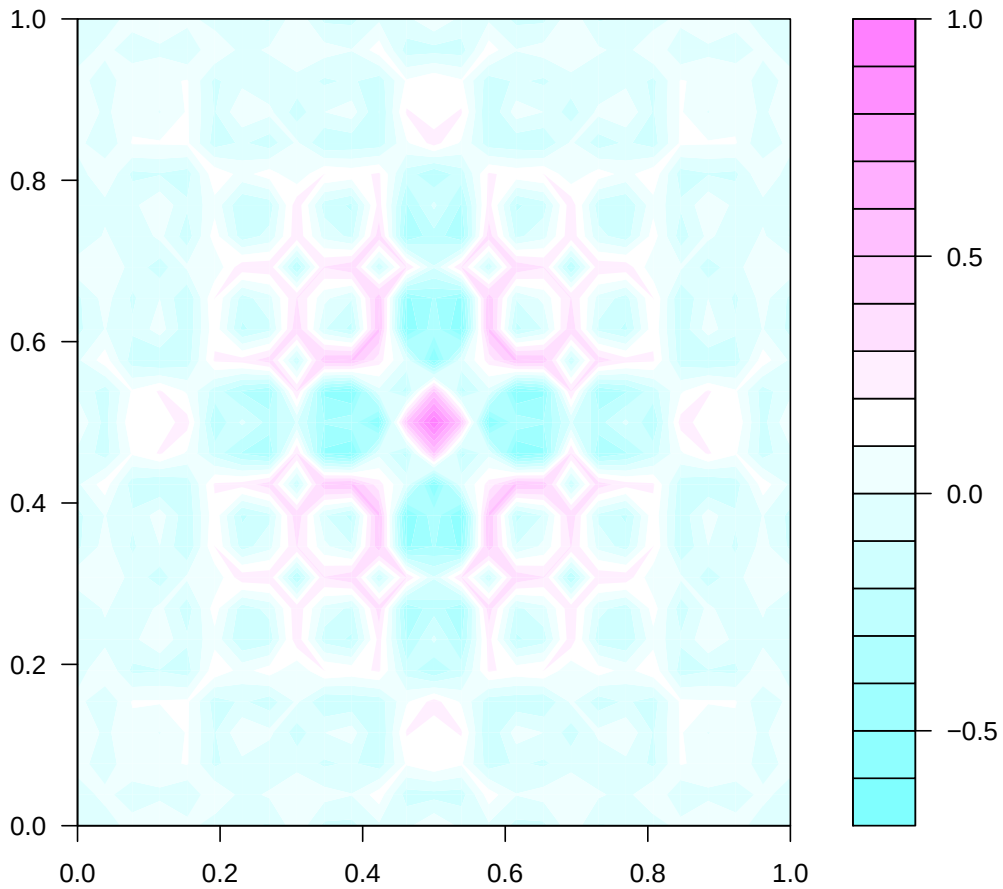


Final solution

Difference

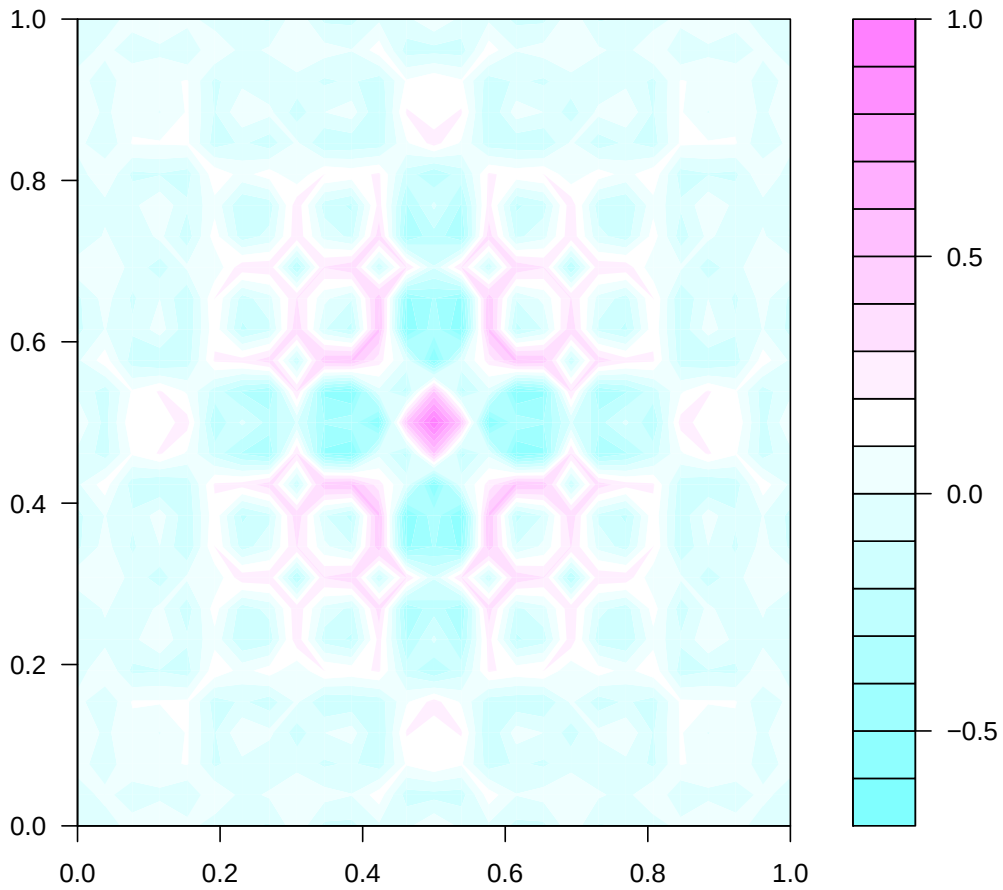
Final solution

> `filled.contour(cos(r^2) * exp(-r/(2 * pi)))`



Final solution

```
> grid.echo()
```



Final solution

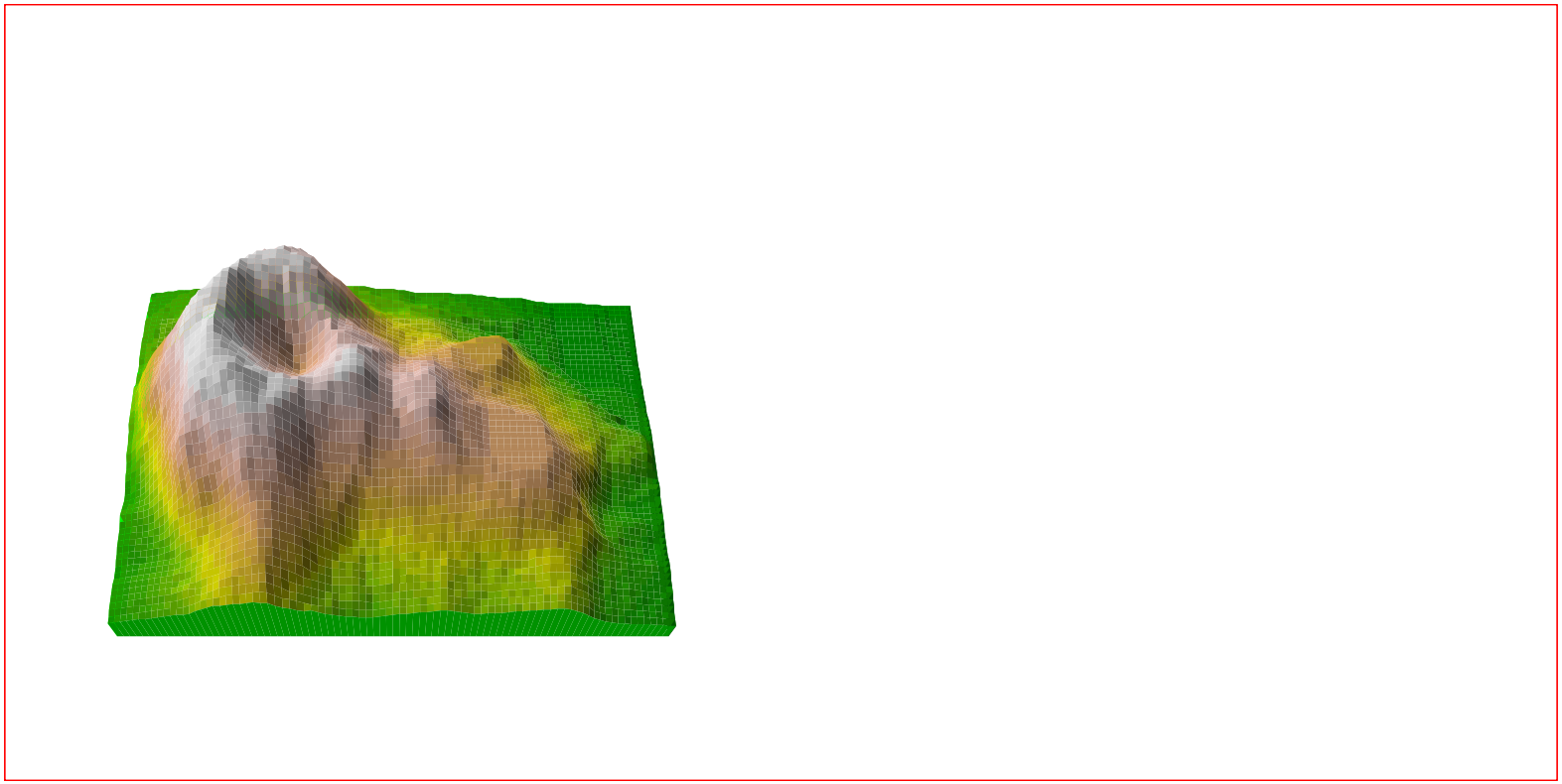
Difference

Why use **grid**?

- **grid** is more flexible
- A compelex plot cannot produced by **graphics** but it might be produced by **grid**

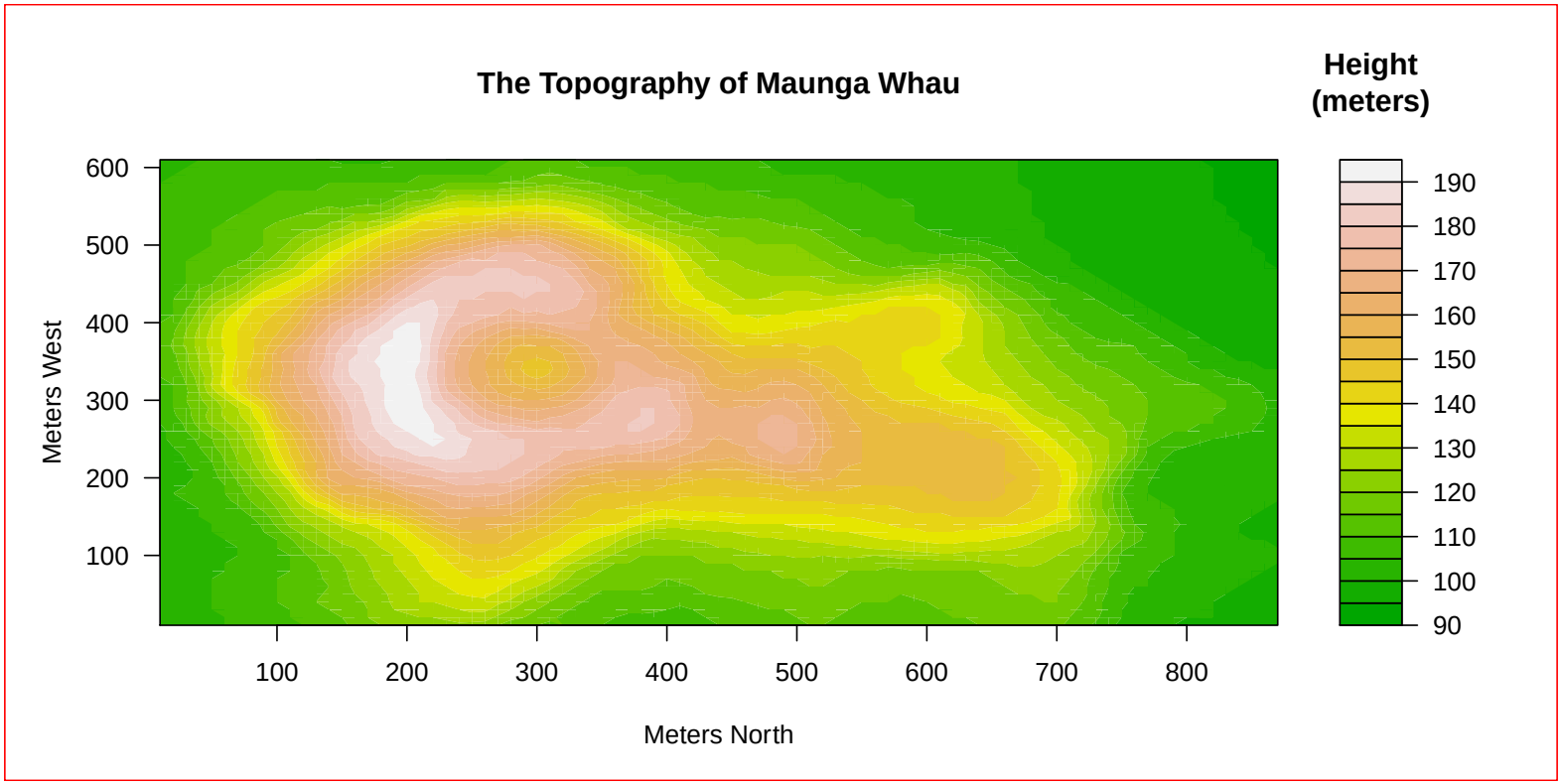
Why use **grid**?

```
> par(mfrow = c(1,2))
> Volcano.persp()
## volcano_filled.contour()
```



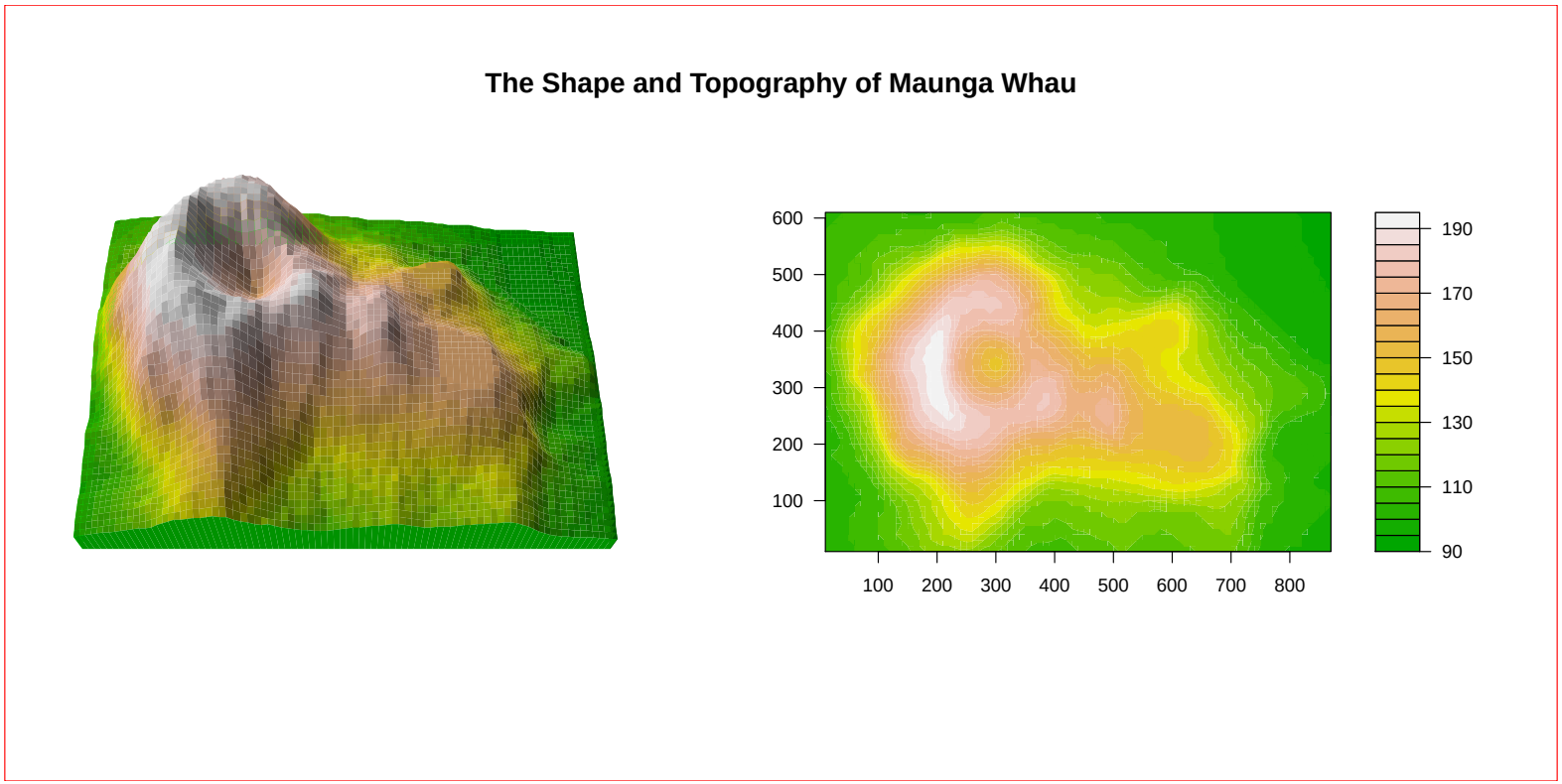
Why use **grid**?

```
> par(mfrow = c(1,2))
> Volcano.persp()
> volcano_filled.contour()
```



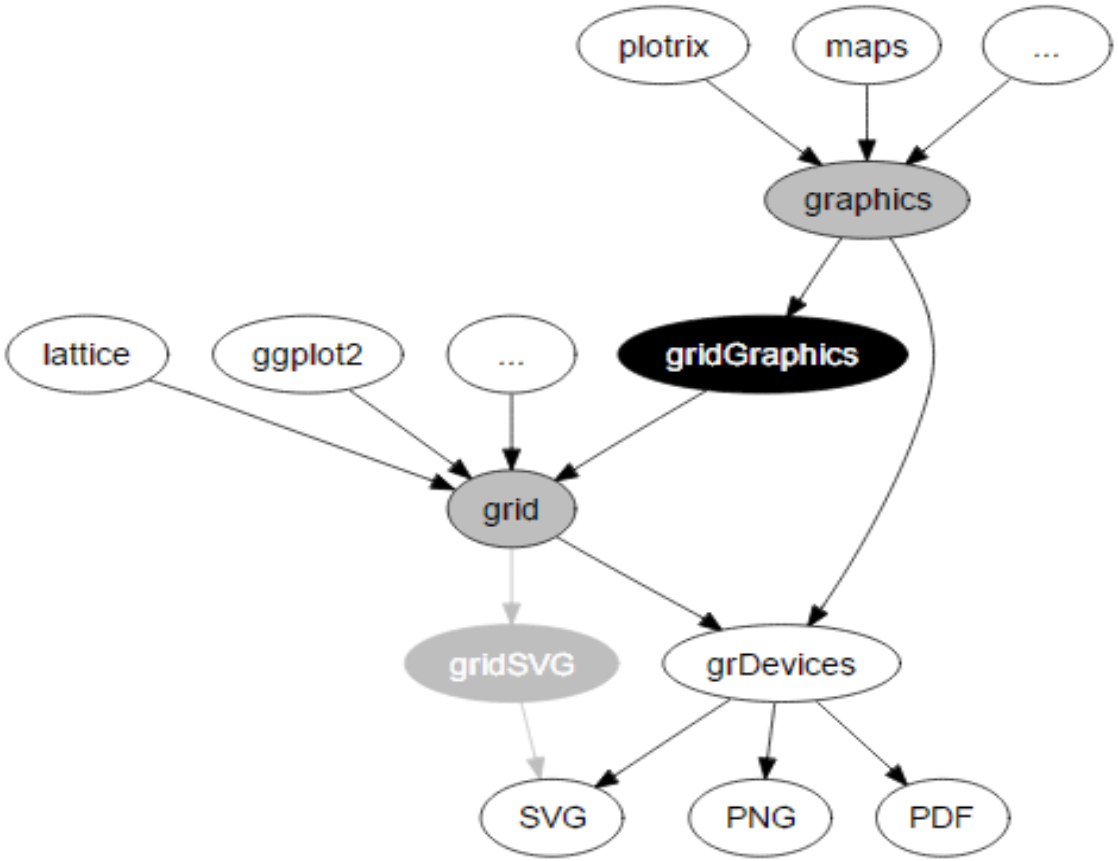
Why use **grid**?

```
> vp <- viewport(...)
> pushViewport(vp)
> grid.echo(Volcano.persp, newpage=FALSE)
> upViewport()
```



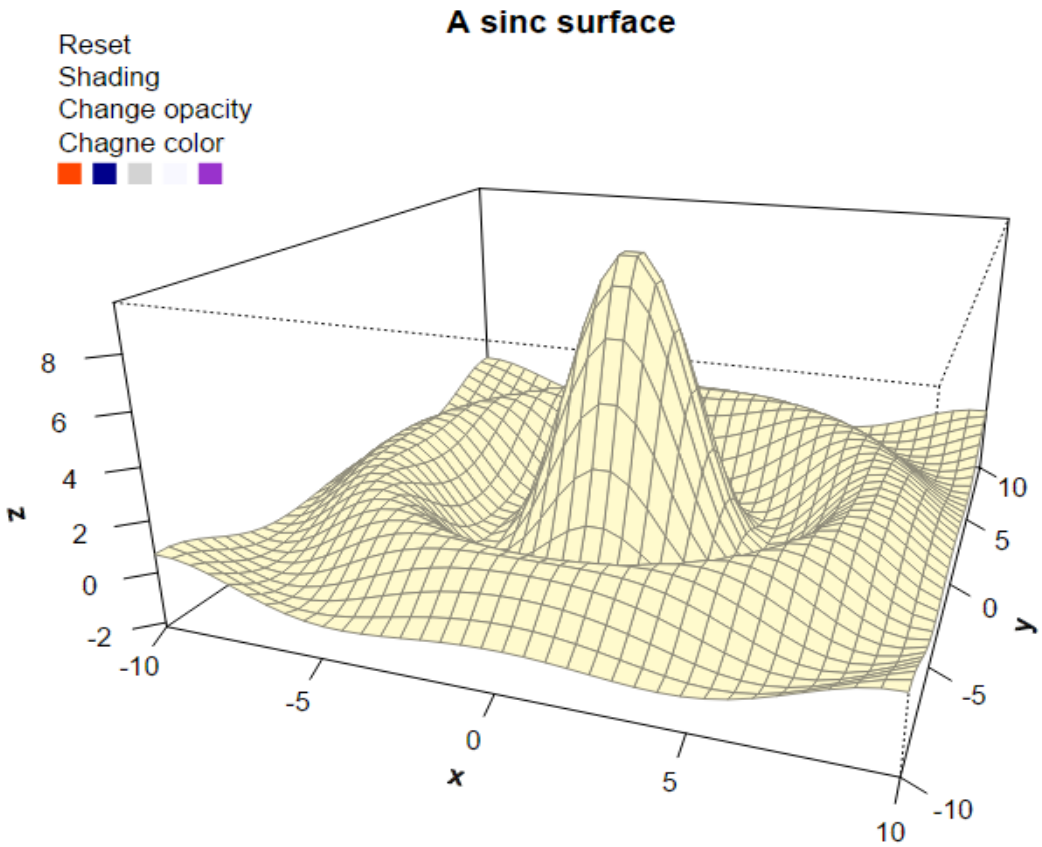
Why use **grid**?

- A **grid**-plot can be export to SVG image by using the **gridSVG**
- The animation and interaction of this SVG image can produced easily.



Why use **grid**?

```
> surface(); addFeatures()
> library(gridSVG)
> grid.script(file = "example.js")
> grid.export("example.svg")
```



Any Question(s)?