

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

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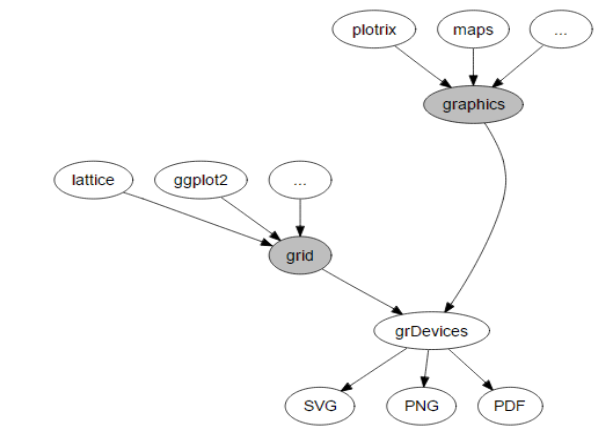
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Introduction

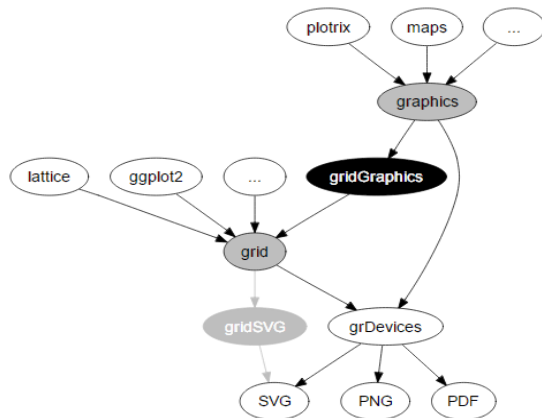
Introduction

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



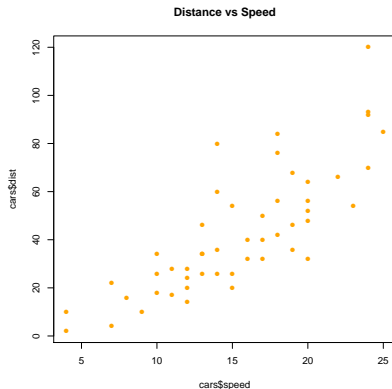
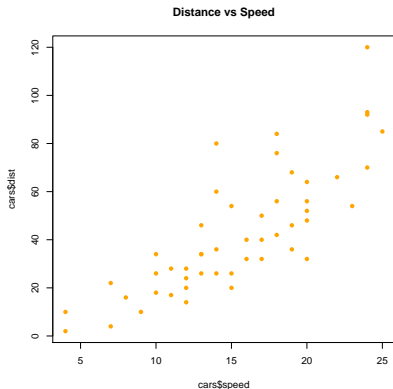
Introduction

What is **gridGraphics**?



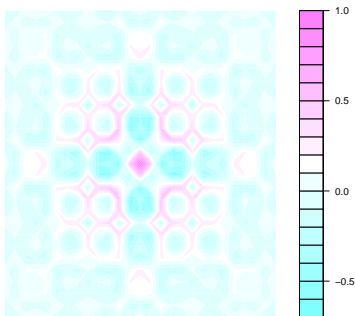
Example

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



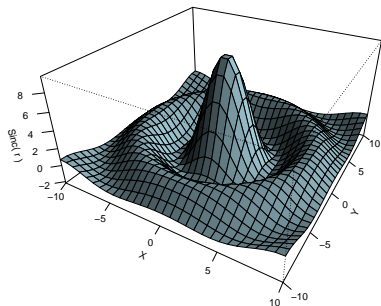
The problem

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



The problem

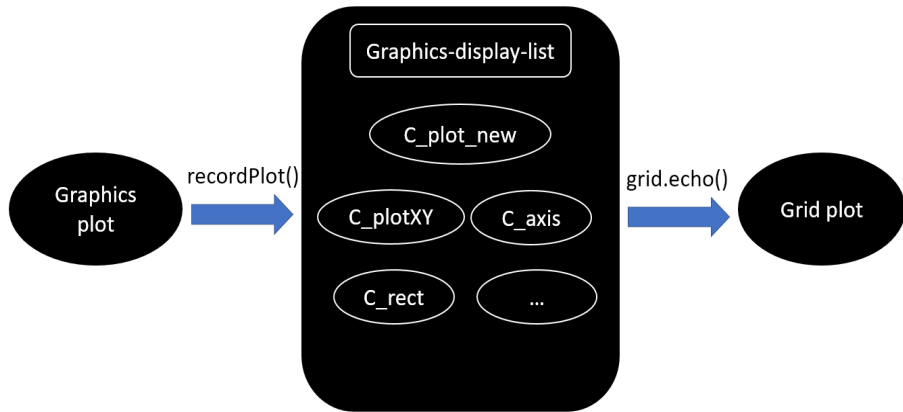
```
> Sinc_Curve() ##persp()  
> grid.echo()
```



The graphics engine display list

The graphics engine display list

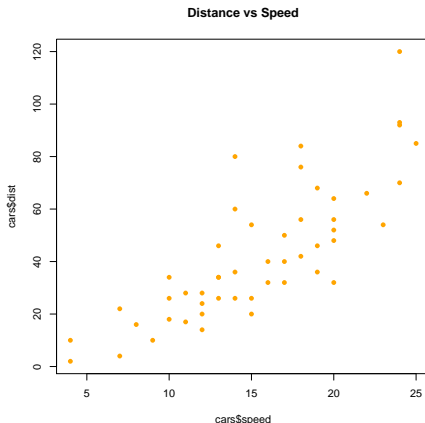
How does **gridGraphics** works?



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"
```



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]);  
    return 1;  
}  
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?

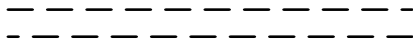
Copy or not copy?

“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)
```

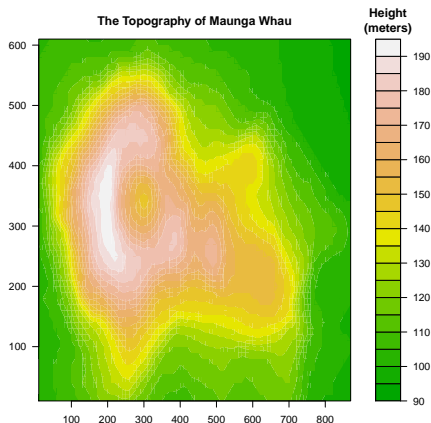


Why not just “copy”?

- 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
```

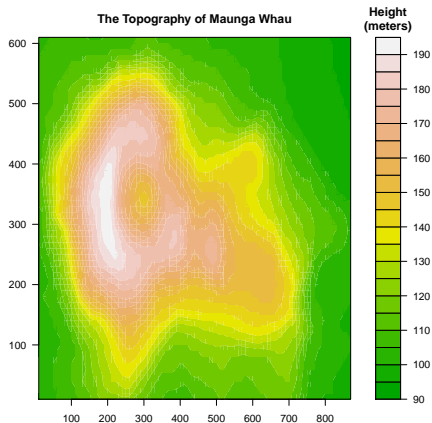
```
# 10.03 0.23 10.32
```

```
## vectorization
```

```
system.time(grid.echo())
```

```
# user system elapsed
```

```
# 1.28 0.53 1.82
```



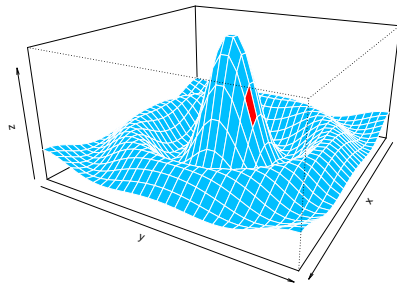
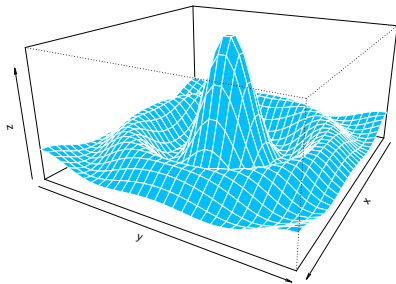
Testing

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

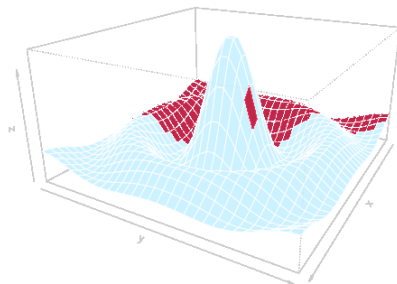
Any difference?

```
## left plot  
Sinc_Curve(col = ??)  
## right plot  
Sinc_Curve(col = ??)
```



```
## color for left plot
col = rgb(red = 0,
          blue = 191,
          green = 255,
          maxColorValue = 255)

## extra diff color for
## right plot
col = rgb(red = 0,
          blue = 190,
          green = 255,
          maxColorValue = 255)
```

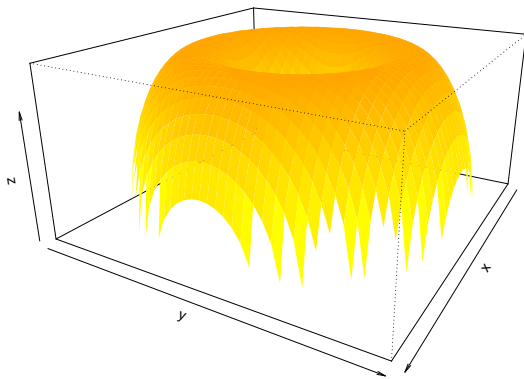


Difference dedcted by using the sorftware **ImageMagick*

Final solution

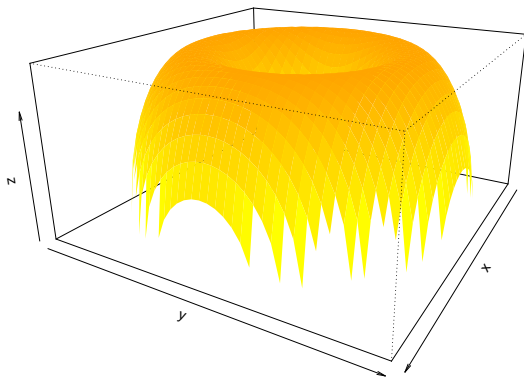
Final solution

> Torus()



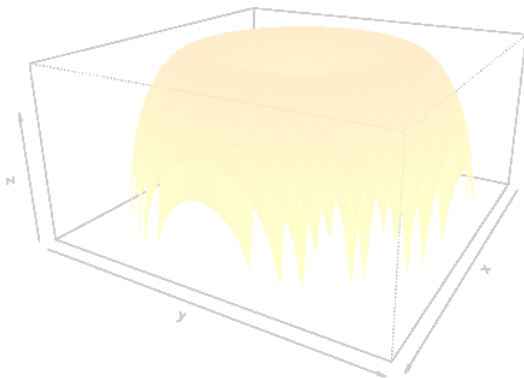
Final solution

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



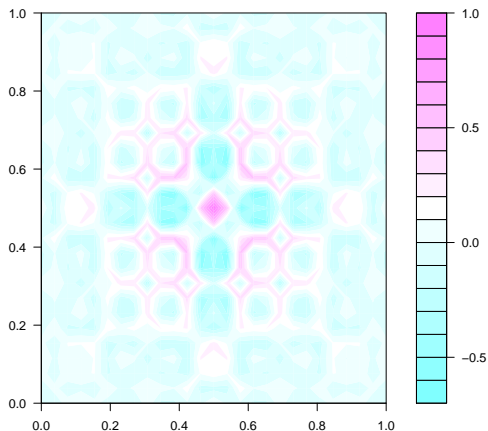
Final solution

Difference



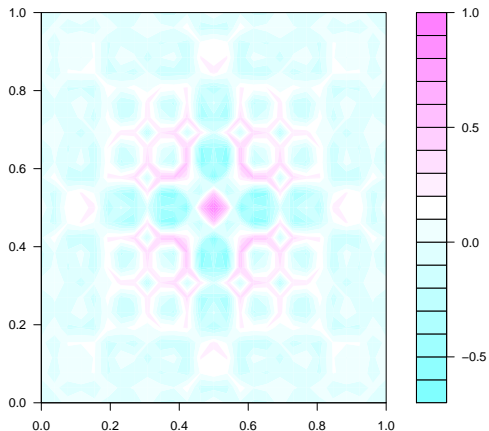
Final solution

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



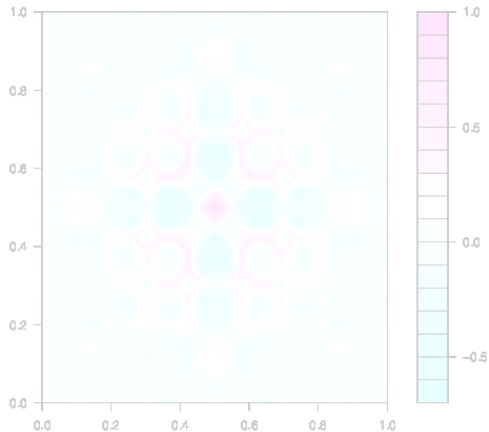
Final solution

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



Final solution

Difference

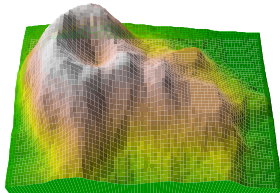


Why use **grid**?

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

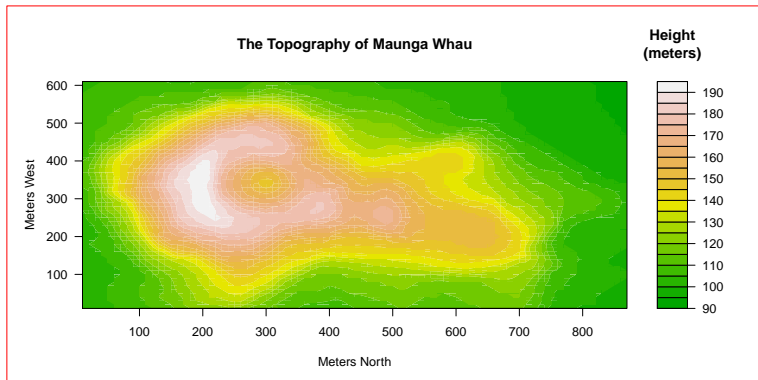
Why use **grid**?

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



Why use **grid**?

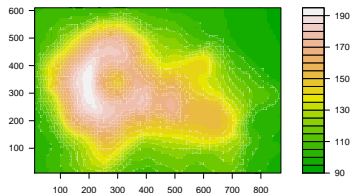
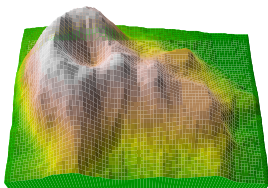
```
> par(mfrow = c(1,2))  
> Volcano.persp()  
> volcano_filled.contour()
```



Why use **grid**?

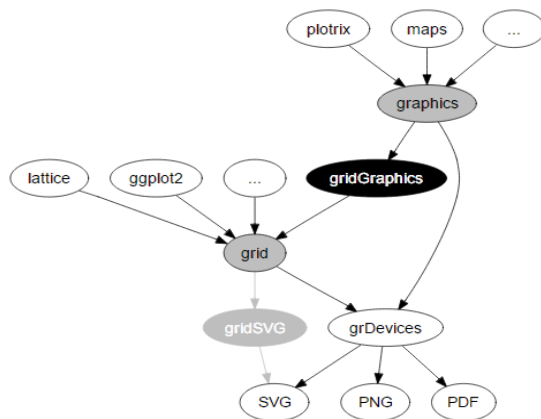
```
> vp = viewport(...)  
> pushViewport(vp)  
> grid.echo(Volcano.persp, newpage=FALSE)  
> upViewport()
```

The Shape and Topography of Maunga Whau



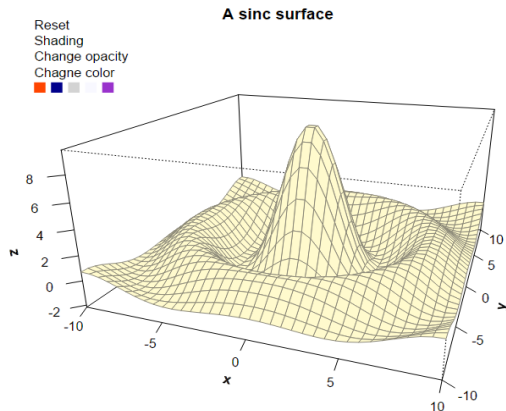
Why use **grid**?

- 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)?