

Omnia sunt Communia! ~ Sobre software, documentación y ciencia libres

Maps with R (I)

18 Sábado feb 2012

PUBLICADO POR OSCAR PERPIÑÁN LAMIGUEIRO EN R-ENGLISH, VISUALIZATION

≈ 38 COMENTARIOS

Etiquetas

choropleth, elections, lattice, maps, New York Times, R

This is the first post of a short series to show some code I have learnt to produce maps with R.

NOTE: Although the procedure described in this post is valid, there is a newer code version in one of the chapters of the book “Displaying time series, spatial and space-time data with R”

Some time ago I found this infographic from The New York Times (via this page) and I wondered how a multivariate choropleth map could be produced with R. Here is the code I have arranged to show the results of the last Spanish general elections in a similar fashion.

Some packages are needed:

```
1 library(maps)
2 library(maptools)
3 ## EDITED: if you have rgeos installed you won't need
4 ## gpclibPermit() below.
5 library(sp)
6 library(lattice)
7 library(latticeExtra)
8 library(colorspace)
```

Let's start with the data, which is available here (thanks to Emilio Torres, who “massaged” the original dataset, available from here).

Each region of the map will represent the percentage of votes obtained by the predominant political option. Besides, only four groups will be considered: the two main parties (“PP” and “PSOE”), the abstention results (“ABS”), and the rest of parties (“OTH”).

```
1 load(url('http://dl.dropbox.com/u/40293713/spainVotes/votos2011.rda'))
2 votesData <- votos2011[, 12:1023] ##I don't need all the columns
3
4 votesData$ABS <- with(votos2011, Total.censo.electoral - Votos.valido)
5
```

```

6 Max <- apply(votesData, 1, max)
7 whichMax <- apply(votesData, 1, function(x)names(votesData)[which.m
8
9 ## OTH for everything but PP, PSOE and ABS
10 whichMax[!(whichMax %in% c('PP', 'PSOE', 'ABS'))] <- 'OTH'
11
12 ## Finally, I calculate the percentage of votes with the electoral c
13 pcMax <- Max/votos2011$Total.censo.electoral * 100

```

The Spanish administrative boundaries are available as shapefiles at the [INE webpage](#) (~70Mb):

```

1 espMap <- readShapePoly(fn="mapas_completo_municipal/esp_muni_0109")
2 Encoding(levels(espMap$NOMBRE)) <- "latin1"
3
4 ##There are some repeated polygons which can be dissolved with
5 ## unionSpatialPolygons.
6 ## EDITED: gpclibPermit() is needed for unionSpatialPolygons to work
7 ## but can be omitted if you have rgeos installed
8 ## (recommended, see comment of Roger Bivand below).
9 espPols <- unionSpatialPolygons(espMap, espMap$PROVMUN)

```

(EDITED, following the question of Sandra). Spanish maps are commonly displayed with the Canarian islands next to the peninsula. First we have to extract the polygons of the islands and the polygons of the peninsula.

```

1 canarias <- sapply(espPols@polygons, function(x)substr(x@ID, 1, 2) %)
2 peninsulaPols <- espPols[!canarias]
3 islandPols <- espPols[canarias]

```

Then we shift the coordinates of the islands:

```

1 dy <- bbox(peninsulaPols)[2,1] - bbox(islandPols)[2,1]
2 dx <- bbox(peninsulaPols)[1,2] - bbox(islandPols)[1,2]
3
4 islandPols2 <- elide(islandPols, shift=c(dx, dy))
5 bbIslands <- bbox(islandPols2)

```

and finally construct a new object binding the shifted islands with the peninsula:

```

1 espPols <- rbind(peninsulaPols, islandPols2)

```

The last step before drawing the map is to link the data with the polygons:

```

1 IDs <- sapply(espPols@polygons, function(x)x@ID)
2 idx <- match(IDs, votos2011$PROVMUN)
3
4 ##Places without information
5 idxNA <- which(is.na(idx))
6
7 ##Information to be added to the SpatialPolygons object
8 dat2add <- data.frame(prov = votos2011$PROV,
9 poblacion = votos2011$Nombre.de.Municipio,
10 Max = Max, pcMax = pcMax, who = whichMax)[idx, ]
11

```

```

12 row.names(dat2add) <- IDs
13 espMapVotes <- SpatialPolygonsDataFrame(espPols, dat2add)
14
15 ## Drop those places without information
16 espMapVotes <- espMapVotes[-idxNA, ]

```

So let's draw the map. I will produce a list of plots, one for each group. The `+.trellis` method of the `latticeExtra` package with `Reduce` superposes the elements of this list and produce a `trellis` object. I will use a set of sequential palettes from the `colorspace` package with a different `hue` for each group.

```

1 classes <- levels(factor(whichMax))
2 nClasses <- length(classes)
3
4 pList <- lapply(1:nClasses, function(i){
5   mapClass <- espMapVotes[espMapVotes$who==classes[i],]
6   step <- 360/nClasses ## distance between hues
7   pal <- rev(sequential_hcl(16, h = (30 + step*(i-1))%360)) ## hues
8   pClass <- spplot(mapClass['pcMax'], col.regions=pal, lwd=0.1,
9     at = c(0, 20, 40, 60, 80, 100))
10 })
11
12 p <- Reduce('+', pList)

```

However, the legend of this `trellis` object is not valid.

First, a title for the legend of each element `pList` will be useful. Unfortunately, the `levelplot` function (the engine under the `spplot` method) does not allow for a title with its `colorkey` argument. The `frameGrob` and `packGrob` of the `grid` package will do the work.

```

1 addTitle <- function(legend, title){
2   titleGrob <- textGrob(title, gp=gpar(fontsize=8), hjust=1, vjust=1)
3   legendGrob <- eval(as.call(c(as.symbol(legend$fun), legend$args)))
4   ly <- grid.layout(ncol=1, nrow=2, widths=unit(0.9, 'grobwidth', da
5   fg <- frameGrob(ly, name=paste('legendTitle', title, sep='_'))
6   pg <- packGrob(fg, titleGrob, row=2)
7   pg <- packGrob(pg, legendGrob, row=1)
8   }
9
10 for (i in seq_along(classes)){
11   lg <- pList[[i]]$legend$right
12   lg$args$key$labels$cex=ifelse(i==nClasses, 0.8, 0) ##only the last
13   pList[[i]]$legend$right <- list(fun='addTitle',
14     args=list(legend=lg, title=classes
15   }

```

Now, every component of `pList` includes a legend with a title below. The last step is to modify the legend of the `p` `trellis` object in order to merge the legends from every component of `pList`.

```

1 ## list of legends
2 legendList <- lapply(pList, function(x){
3   lg <- x$legend$right

```

```

4   clKey <- eval(as.call(c(as.symbol(lg$fun), lg$args)))
5   clKey
6 })
7
8   ##function to pack the list of legends in a unique legend
9   ##adapted from latticeExtra::: mergedTrellisLegendGrob
10  packLegend <- function(legendList){
11    N <- length(legendList)
12    ly <- grid.layout(nrow = 1, ncol = N)
13    g <- frameGrob(layout = ly, name = "mergedLegend")
14    for (i in 1:N) g <- packGrob(g, legendList[[i]], col = i)
15    g
16  }
17
18  ## The legend of p will include all the legends
19  p$legend$right <- list(fun = 'packLegend', args = list(legendList =

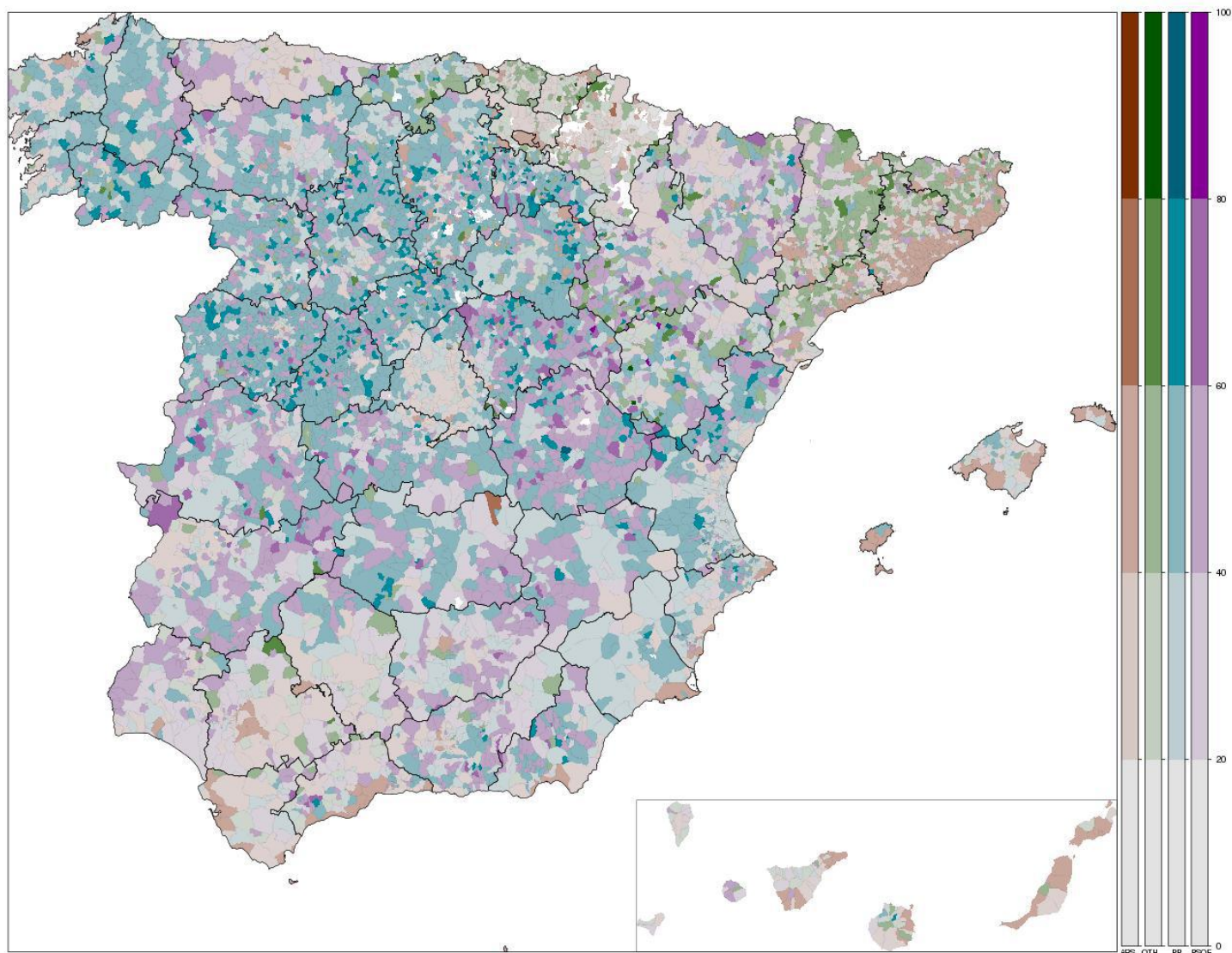
```

Here is the result with the provinces boundaries superposed (only for the peninsula due to a problem with the definition of boundaries the Canarian islands in the file) and a rectangle to separate the Canarian islands from the rest of the map (click on the image to get a SVG file):

```

1   provinces <- readShapePoly(fn="mapas_completo_municipal/spain_provinci
2
3   canarias <- provinces$PROV %in% c(35, 38)
4   peninsulaLines <- provinces[!canarias,]
5
6   p +
7     layer(sp.polygons(peninsulaLines, lwd = 0.5)) +
8     layer(grid.rect(x=bbIslands[1,1], y=bbIslands[2,1],
9                     width=diff(bbIslands[1,]),
10                    height=diff(bbIslands[2,]),
11                    default.units='native', just=c('left', 'bottom'),
12                    gp=gpar(lwd=0.5, fill='transparent'))))

```



Related articles

- [Maps with R \(II\)](#)
- [Maps with R \(III\)](#)
- [Spatial data visualization with R](#)
- [Stamen maps with spplot](#)

About these ads

You May Like

- 1.



pensamientos sobre “Maps with R (I)”

1. *dijo:*melodyaross

08/04/2014 en 0:50

Man, I wish I could get a pdf of this!

RESPONDER

◦ *dijo:*Oscar Perpiñán Lamigueiro

08/04/2014 en 9:11

Have you tried “Print > Save as a File...”?

RESPONDER

2. Pingback: Una de mapas con R

3. Pingback: Una de mapas con R » G. R. Serrano

4. *dijo:*Paco

22/04/2013 en 4:39

Hello, Oscar

I’m a undergraduate student and I’m new using R for maps. Do you know how to remove, in this case, Canadian Islands from the map?

RESPONDER

◦ *dijo:*Oscar Perpiñán Lamigueiro

22/04/2013 en 11:10

Hello,

You can drop the Canarian islands if you substitute `espPols` with `peninsulaPols` in the code or if, instead of `espPols <- rbind(peninsulaPols, islandPols2)` you use `espPols <- peninsulaPols`.

Cheers,

Oscar.

RESPONDER

5. *dijo:*<http://google.com>

12/02/2013 en 19:58

“Maps with R (I)  Omnia sunt Communia!” was in fact a truly awesome blog, .

Continue composing and I’m going to continue to keep reading through! I appreciate it ,Julia

RESPONDER

6. *dijo:pvaldes*

31/10/2012 en 18:45

Es-pec-ta-cular...

la clase de ejemplos que crean escuela

RESPONDER

◦ *dijo:***Oscar Perpiñán Lamigueiro**

01/11/2012 en 18:35

Muchas gracias.

RESPONDER

7. Pingback: [datanalytics » Veinte herramientas de visualización](#)

8. *dijo:manuel*

14/06/2012 en 9:07

amazing, ... but seems a little problem with “finisterrae”?

RESPONDER

◦ *dijo:***Oscar Perpiñán Lamigueiro**

14/06/2012 en 9:24

Oops. You are right. And I love that region! I have to find a fix.

RESPONDER

9. *dijo:jcberman*

09/05/2012 en 16:58

Dear Oscar,

I believe I faithfully copied the code, loaded the data, installed the libraries, but after some think time I only get a big white window. I did check some of the variables and they are populated, .and the graphics demos work fine. Any suggestions as I am new to R.

Thanks,

RESPONDER

- *dijo:***Oscar Perpiñán Lamigueiro**

09/05/2012 en 17:46

Hello,

Try to write a PDF file with the graphic. For example:

```
trellis.device(pdf, file='map.pdf')  
print(p)  
dev.off()
```

Does it work?

Oscar.

RESPONDER

- *dijo:***jcberman**

09/05/2012 en 18:23

Hi Oscar,

The PDF is perfect. Thank you for the suggestion.

- *dijo:***Oscar Perpiñán Lamigueiro**

09/05/2012 en 19:48

Then the problem is with your default graphical device. Try to change its settings.

Best,

Oscar.

10. *dijo:***jcberman**

09/05/2012 en 16:55

I was wondering if you could help me. I believe I copied all of the lines of code, got the right files, and installed the appropriate libraries, but all I get after some think time, is a all white window labeled QUartz 1 [*]. The vairables seem to be populated., just no picture. Other graphics work fine, i.e. demo(labels)

Thanks for any suggestions.

RESPONDER

11. *dijo:***Sandra**

17/04/2012 en 19:08

Dear Oscar,

I have been working with the Spanish map for quite some time, and now that I want to make a nice map with latitude and longitude coordinates (of Spain mainland) with the Canary island in a box in the bottom left corner I am at loss (I can do that without axes, but with it just doesn't work). I think it's a rather stupid problem, easily solved... but just cannot see how!

Thanks for any help...

Cheers!

RESPONDER

◦ *dijo:***Oscar Perpiñán Lamigueiro**

18/04/2012 en 12:48

Hello Sandra,

I have edited the post to include the islands. The trick is to use `ellide` (from `maptools`) and `rbind`. If you need the latitude/longitude values use `"scales=list(draw=TRUE)"` inside `spplot`. Hope it helps!

Oscar.

RESPONDER

12. *dijo:***dog snuggie**

09/03/2012 en 4:33

Interesting...

RESPONDER

13. *dijo:***Tinoush Jamali**

07/03/2012 en 18:17

Dear Oscar,

Many thanks for your post. I have a question. Do you think that there is any possibility to add the direction and size between the areas, regions or countries to the map in R. I add a link here and if you scroll down, you can see what I mean:

<http://ucatlas.ucsc.edu/trade/tradeflows.htm>

Is it possible to bring the arrows with weight of that for relation among the regions into the map in R.

Sorry for bothering you with this question and thanks for you response.

Regards,
Tinoush

RESPONDER

- *dijo:***Oscar Perpiñán Lamigueiro**

07/03/2012 en 18:49

Hello Tinoush,

I think this post will be useful for your needs.

Best,

Oscar.

RESPONDER

14. Pingback: Mapas con R en Omnia sunt Communia! » Análisis y decisión

15. *dijo:***margaretrdonald**

26/02/2012 en 4:23

Thanks for some really nice stuff. However even though I had loaded rgeos the line

```
espPols <- unionSpatialPolygons(espMap, espMap$PROVMUN)
```

failed until I put
require(gpclib)
gpclibPermit()
before it...

Cheers,
Margaret Donald

RESPONDER

- *dijo:***Oscar Perpiñán Lamigueiro**

27/02/2012 en 0:14

I am not sure but perhaps it is only a problem of old versions. Could you try updating both rgeos and maptools?

Oscar.

RESPONDER

16. *dijo:*Roger Bivand

20/02/2012 en 20:48

Very nice! Please note that gpclibPermit() is not needed, as unionSpatialPolygons() will use gUnaryUnion() in rgeos instead of encumbered gpclib functions. Support for gpclib in maptools will go away very soon now, as rgeos is available for all platforms.

RESPONDER

- *dijo:***Oscar Perpiñán Lamigueiro**

21/02/2012 en 12:52

Thanks for the info, Roger. I have edited the post.

However, I found that (at least at CRAN) rgeos is not available for MacOSX:

<http://cran.r-project.org/web/packages/rgeos/index.html>

RESPONDER

- *dijo:***Roger Bivand**

22/02/2012 en 17:53

It has been made available by Prof. Brian Ripley for OSX Intel architectures. All you need to do is to ensure that the first two repositories are on the search path, so:

```
setRepositories(ind=1:2)
library(rgeos)
```

Then you get your shiny rgeos, I think now with the very latest GEOS inside. Maybe I should add this advice to the package description!

17. *dijo:*MarioLosada

19/02/2012 en 16:10

Excelente Trabajo!, de mucha ayuda

Has llegado a usar el GeoTools for Java?

RESPONDER

- *dijo:***Oscar Perpiñán Lamigueiro**

19/02/2012 en 17:17

Gracias, me alegra que sea útil.

No he usado GeoTools. Me lo apunto en la lista de tareas .

RESPONDER

18. *dijo:*Marcelo Lugo

19/02/2012 en 14:56

Hello!

I'm trying to replicate your steps, but I keep getting the following error:

```
> votesData$ABS <- with(votos2011, Total.censo.electoral - Votos.válidos) ## abstention
Error en eval(expr, envir, enclos) : objeto 'Votos.válidos' no encontrado
```

Thanks,

Marcelo Lugo

RESPONDER

- *dijo:***Oscar Perpiñán Lamigueiro**

19/02/2012 en 17:09

Hello, Erin, Marcelo.

I think the problem you are having is related to the use of non-ASCII character in the names of “votos2011”. I have changed “Votos.válidos” to “Votos.validos” in the dataset and in the code. Please let me know if this fix works for you.

Cheers.

Oscar.

RESPONDER

- *dijo:***Erin Hodgess**

20/02/2012 en 8:32

Hello again!

Thanks for the great fix on the variable names.

However, I’m having trouble with the zip file. I keep getting that the downloaded file is not a valid zip file. I’m using Windows.

Should I be using Linux, please?

Thanks,

Erin

- *dijo:***Oscar Perpiñán Lamigueiro**

20/02/2012 en 12:11

Hello,

If I am not wrong, the zip from the INE webpage is created with the compression format 7z. Try the 7-zip software to open it.

Oscar.

19. *dijo:*Erin Hodgess

19/02/2012 en 8:01

Hello!

I'm trying to replicate your steps, but I keep getting the following error:

```
> votesData$ABS
```

When I checked the names on votos2011, there is no Votos.validos.

Have you run into this please?

Thanks,

Erin

RESPONDER

!0. *dijo:*Luis

18/02/2012 en 23:58

¡Muchas gracias! It is great to find such a detailed explanation of the whole process of map creation. I can think quite a few variants of the map, but your code provides the starting point for all of them.

Saludos desde New Zealand.

RESPONDER

!1. *dijo:*Tim Riffe

18/02/2012 en 19:32

brilliant work! I realize that the political landscape in Spain is more than 2 dimensional, but did you think of reducing the variables to a single gradient, e.g. from left to right, rather than choosing a dominant party? In the US it works rather well, with purples dominating in places with an evenly split electorate, and red and blue on the extremes. For Spain you'd have to do some ad hoc party aggregating. One could also make the political choropleth for nationalist vs centralist parties using a continuous color ramp. Not to make your life more difficult, but I think this and other maps from the same data source are of high interest in Spain. Cheers!

RESPONDER

◦ *dijo:*Oscar Perpiñán Lamigueiro

19/02/2012 en 17:23

I decided to use this dataset to play with several variables in a map, and thus building a "complex" legend, and to show the relevance of the abstention in Spain (which is the most important choice in several locations).

Thanks for your ideas!

RESPONDER

Blog de WordPress.com. El tema Chateau.

Seguir

Seguir “Omnia sunt Communia!”

}8

Ofrecido por WordPress.com