

The Lattice Plotting System in R

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The Lattice Plotting System

The lattice plotting system is implemented using the following packages:

- · *lattice*: contains code for producing Trellis graphics, which are independent of the "base" graphics system; includes functions like xyplot, bwplot, levelplot
- · grid: implements a different graphing system independent of the "base" system; the lattice package builds on top of grid
 - We seldom call functions from the *grid* package directly
- · The lattice plotting system does not have a "two-phase" aspect with separate plotting and annotation like in base plotting
- · All plotting/annotation is done at once with a single function call

Lattice Functions

- xyplot: this is the main function for creating scatterplots
- bwplot: box-and-whiskers plots ("boxplots")
- · histogram: histograms
- · stripplot: like a boxplot but with actual points
- dotplot: plot dots on "violin strings"
- · splom: scatterplot matrix; like pairs in base plotting system
- · levelplot, contourplot: for plotting "image" data

Lattice Functions

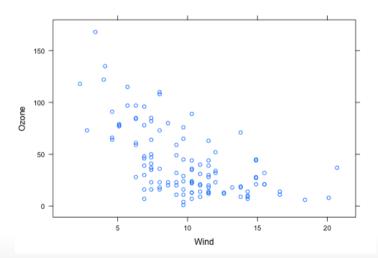
Lattice functions generally take a formula for their first argument, usually of the form

```
xyplot(y ~ x | f * g, data)
```

- · We use the formula notation here, hence the ~.
- · On the left of the ~ is the y-axis variable, on the right is the x-axis variable
- · f and g are conditioning variables they are optional
 - the * indicates an interaction between two variables
- · The second argument is the data frame or list from which the variables in the formula should be looked up
 - If no data frame or list is passed, then the parent frame is used.
- · If no other arguments are passed, there are defaults that can be used.

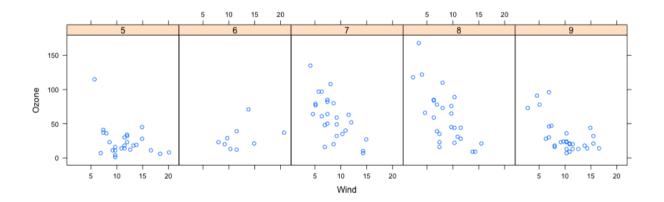
Simple Lattice Plot

```
library(lattice)
library(datasets)
## Simple scatterplot
xyplot(Ozone ~ Wind, data = airquality)
```



Simple Lattice Plot

```
library(datasets)
library(lattice)
## Convert 'Month' to a factor variable
airquality <- transform(airquality, Month = factor(Month))
xyplot(Ozone ~ Wind | Month, data = airquality, layout = c(5, 1))</pre>
```



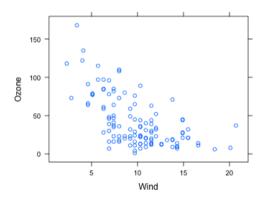
Lattice Behavior

Lattice functions behave differently from base graphics functions in one critical way.

- · Base graphics functions plot data directly to the graphics device (screen, PDF file, etc.)
- · Lattice graphics functions return an object of class trellis
- The print methods for lattice functions actually do the work of plotting the data on the graphics device.
- Lattice functions return "plot objects" that can, in principle, be stored (but it's usually better to just save the code + data).
- · On the command line, trellis objects are *auto-printed* so that it appears the function is plotting the data

Lattice Behavior

```
p <- xyplot(Ozone ~ Wind, data = airquality) ## Nothing happens!
print(p) ## Plot appears</pre>
```



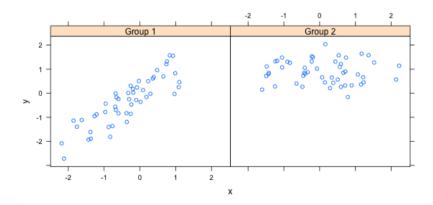
```
xyplot(Ozone ~ Wind, data = airquality) ## Auto-printing
```

Lattice Panel Functions

- · Lattice functions have a **panel function** which controls what happens inside each panel of the plot.
- The *lattice* package comes with default panel functions, but you can supply your own if you want to customize what happens in each panel
- · Panel functions receive the x/y coordinates of the data points in their panel (along with any optional arguments)

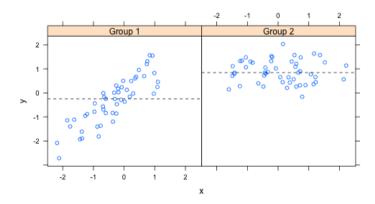
Lattice Panel Functions

```
set.seed(10)
x <- rnorm(100)
f <- rep(0:1, each = 50)
y <- x + f - f * x + rnorm(100, sd = 0.5)
f <- factor(f, labels = c("Group 1", "Group 2"))
xyplot(y ~ x | f, layout = c(2, 1)) ## Plot with 2 panels</pre>
```



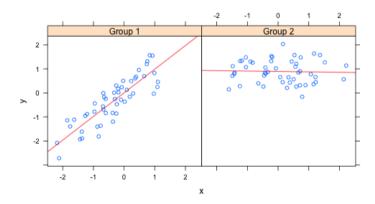
Lattice Panel Functions

```
## Custom panel function
xyplot(y ~ x | f, panel = function(x, y, ...) {
   panel.xyplot(x, y, ...) ## First call the default panel function for 'xyplot'
   panel.abline(h = median(y), lty = 2) ## Add a horizontal line at the median
})
```



Lattice Panel Functions: Regression line

```
## Custom panel function
xyplot(y ~ x | f, panel = function(x, y, ...) {
   panel.xyplot(x, y, ...) ## First call default panel function
   panel.lmline(x, y, col = 2) ## Overlay a simple linear regression line
})
```



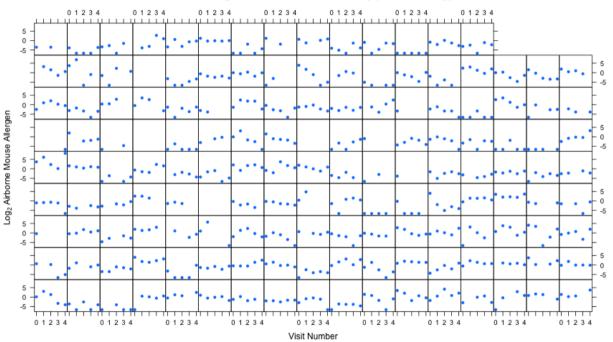
Many Panel Lattice Plot: Example from MAACS

- · Study: Mouse Allergen and Asthma Cohort Study (MAACS)
- · Study subjects: Children with asthma living in Baltimore City, many allergic to mouse allergen
- · Design: Observational study, baseline home visit + every 3 months for a year.
- · Question: How does indoor airborne mouse allergen vary over time and across subjects?

Ahluwalia et al., Journal of Allergy and Clinical Immunology, 2013

Many Panel Lattice Plot





Summary

- · Lattice plots are constructed with a single function call to a core lattice function (e.g. xyplot)
- · Aspects like margins and spacing are automatically handled and defaults are usually sufficient
- The lattice system is ideal for creating conditioning plots where you examine the same kind of plot under many different conditions
- · Panel functions can be specified/customized to modify what is plotted in each of the plot panels