**Lattice Plotting System**

* **Lattice Plotting System consist of**
  + - Lattice: includes xyplot, bwplot, levelplot
    - Grid package
    - Lattice does not have a 2-phase aspect with separate plotting and annotation like base
    - All plotting and annotation are done with 1 function
* **Lattice functions**
  + - Xyplot – main function for scatterplots
    - Bwplot – box-and-whiskers plots
    - Histogram – histograms
    - Stripplot – like boxplot with actual points
    - dotplot – plot dots on “violin strings”
    - splom – scatterplot matrix, like pairs
    - levelplot, contourplot – for image data
* **How does the function look like?**

Xyplot(y ~ x | f \* g, data)

* + - Y ~ x 🡺 y depends on x
    - F – g, conditioning variables, this is optional
    - Data: the data frames that y and x should come from
* **Simple lattice plot**

Library(lattice)

Library(datasets\_

Xyplot(Ozone ~ Wind, data = airquality)

Airquality <- transform(airquality, Month = factor(Month))

Xyplot(Ozone ~ Wind | Month, data = airquality, layout = c(5, 1))

* **Lattice behavior**
  + - Base graphics functions plot data directly do the graphic device
    - Lattice graphic functions return an object of class trellis
    - On the command line, trellis objects are auto printed 🡺 no worries
* **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

**ggplot2**

* **What is ggplot2?**
  + - install.packages()
    - <https://ggplot2.org>
    - Represents the abstraction of graphic ideas/objects
* **The basics**
  + - Qplot() – like a plot function
    - Looks for data in a data frame, like lattice
    - Plots are made up of *aesthetics* (size, shape, color) and *geoms* (points, lines)
    - ggplot() is the core function and can do everything
* **Example** 
  + - Qplot() is like plot() but with many built-in features
* **Basic components of ggplot2 plot**
  + - A data frame
    - Aesthetic mappings – how data are mapped to color, size
    - Geoms – geometric objects like points, lines, shapes
    - Facets – for conditional plots
    - Stats – statistical transformations like binning, quantiles, smoothing
    - Scales – what scale an aesthetic map uses – ex. Male = red, female = blue
    - Coordinate system
* **Building plots with ggplot2**
  + - Plots are built up in layers
      * Plot the data
      * Overlay a summary
      * Metadata and annotation
* **Annotation** 
  + - Labels
      * Xlab(), ylab(), labs(), ggtitle()
    - Each of the geom\_() functions can be modified
    - For global things – theme(legend.position = “none”)
    - Standard themes
      * Theme\_gray()
      * Theme\_bw()