

R grid Graphics

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Back

Close

Overview

- A user's view of statistical graphics
- A developer's view of statistical graphics
- Making the transition via `grid`



Back

Close

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Back

Close

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Back

Close

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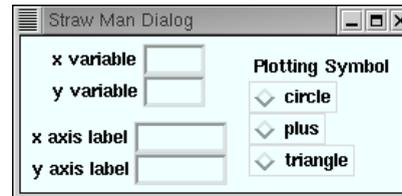
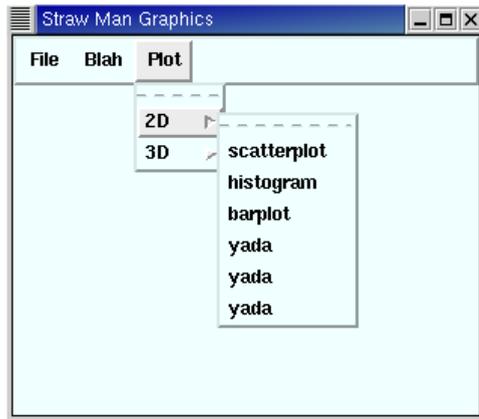
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Back

Close

A User's View



Back

Close

A User's View

- Advantages
 - High-level conceptual view
- Disadvantages
 - Eventually discover something impossible
 - Unable to see what is possible



Back

Close

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Back

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Back

Close

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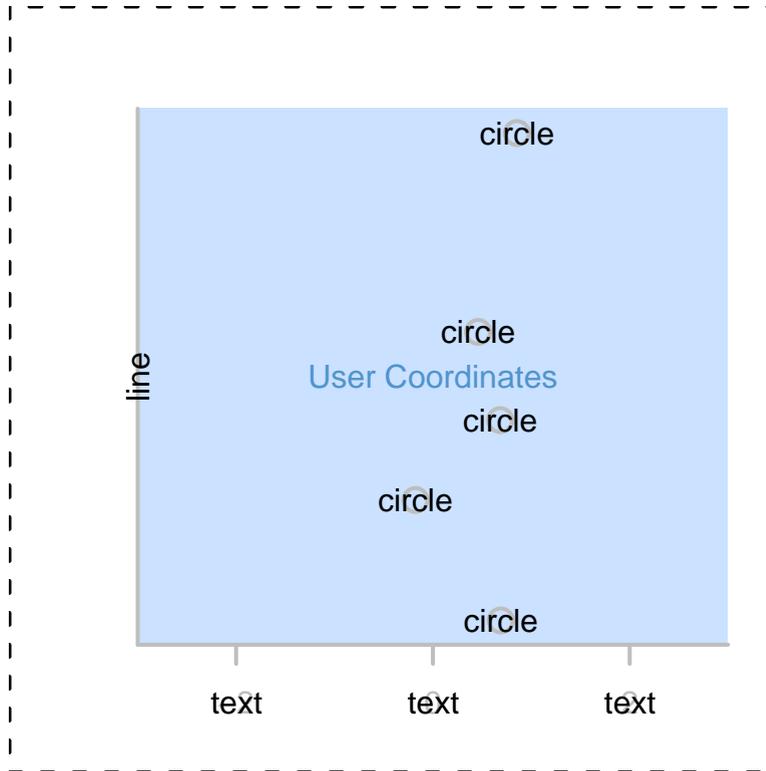
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Back

Close

A Developer's View



Back

Close

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Back

Close

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Back

Close

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Back

Close

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Back

Close

The Transition from User to Developer

The S Language (S-Plus and R) is designed to blur the distinction and ease the transition between users and developers of statistical analysis and graphics software.

- High-level plotting functions (e.g., `plot()`)
- Low-level plotting functions (e.g., `lines()`, `text()`)



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The Transition from User to Developer

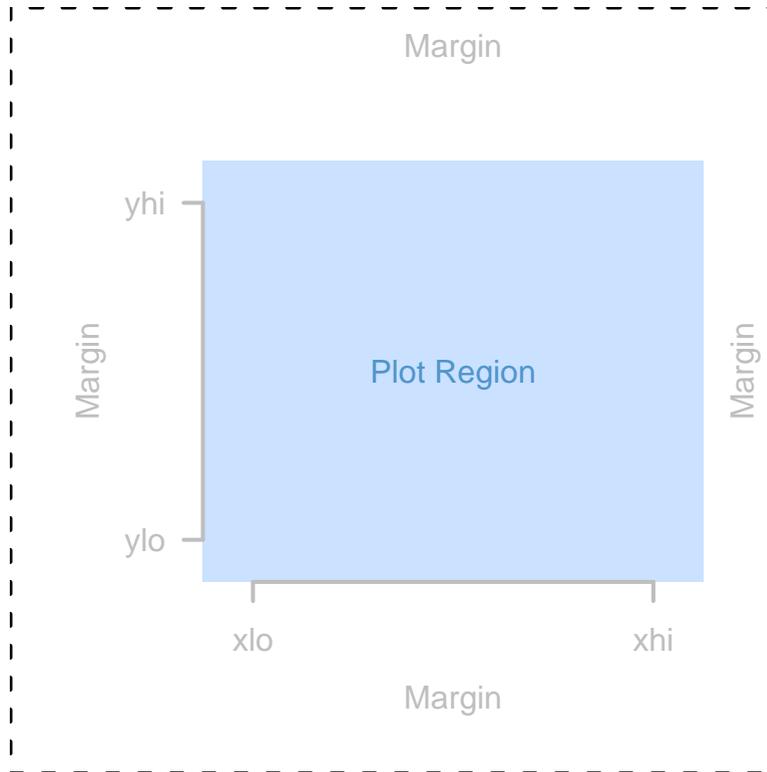
In the S tradition, the `grid` add-on package for R is an attempt to provide users with a developer's view of statistical graphics.



Back

Close

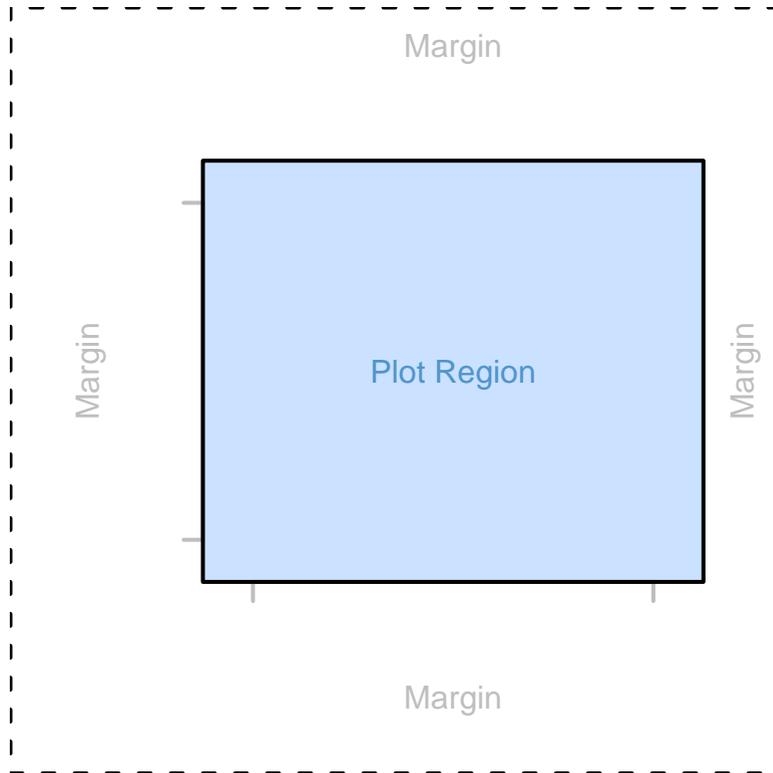
A Developer Constructs a Scatterplot



Back

Close

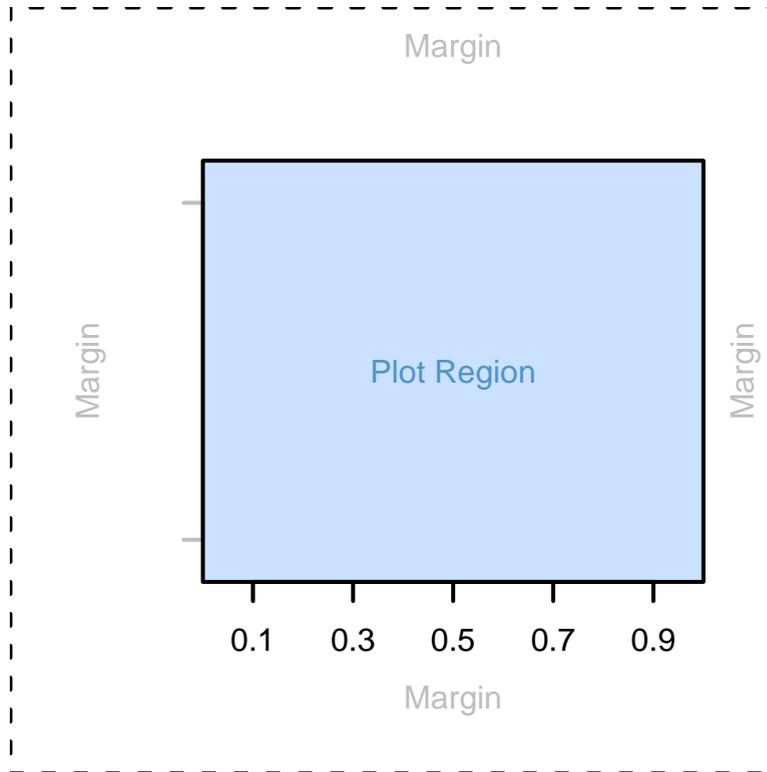
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Back

Close

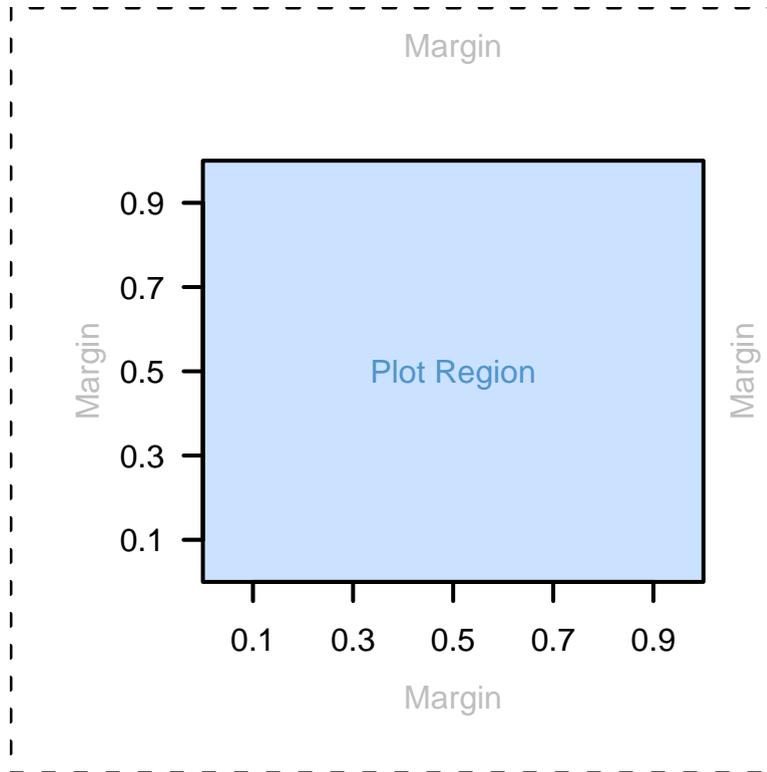
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Back

Close

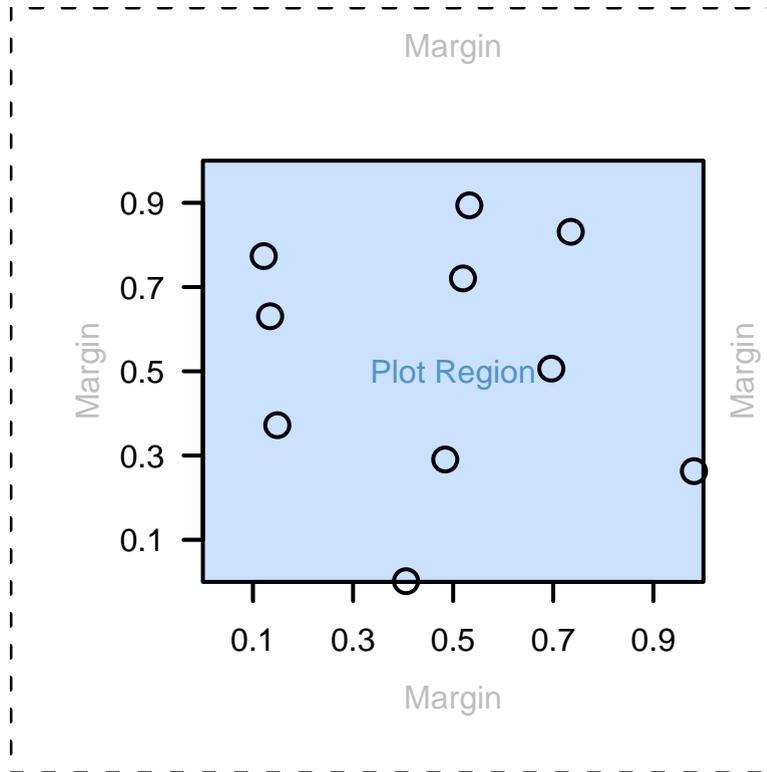
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Back

Close

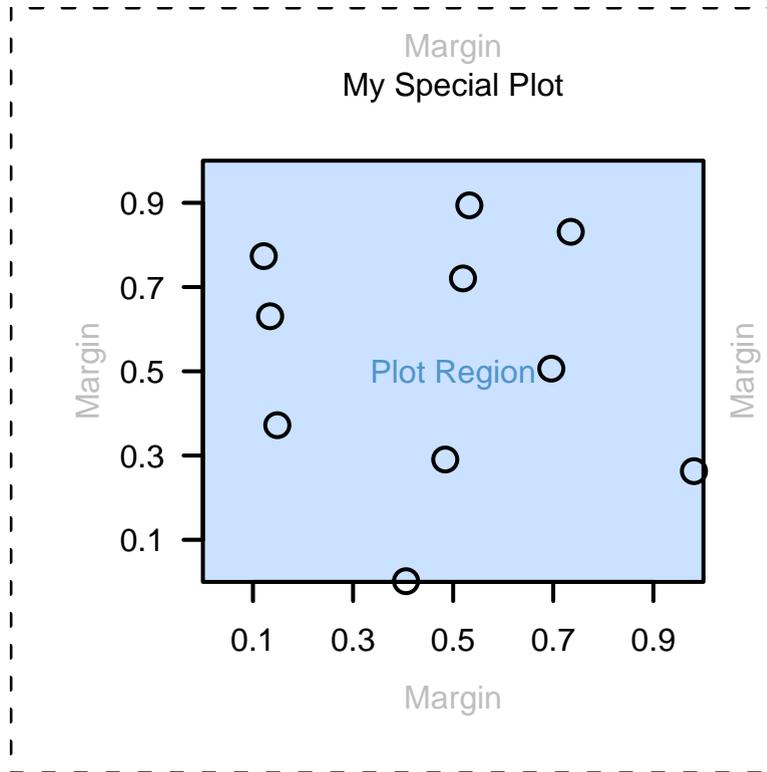
A Developer Constructs a Scatterplot



Back

Close

A Developer Constructs a Scatterplot



Back

Close

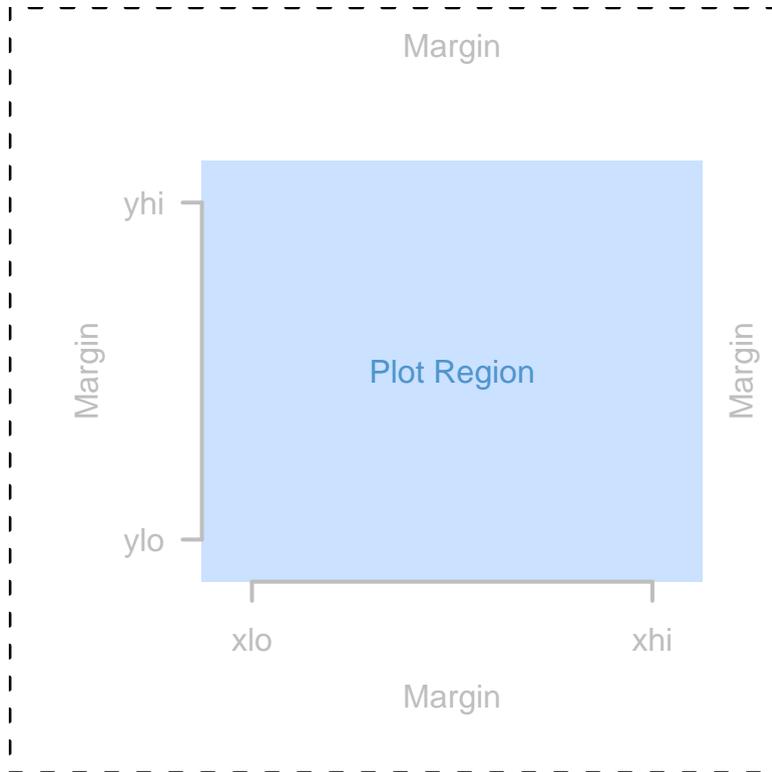
grid Viewports

- grid viewports define a rectangular region and associate several coordinate systems with the region.

```
R> push.viewport(plotViewport(c(5, 5, 4, 2)))
```



grid Viewports



Back

Close

grid Graphical Objects

- grid provides various objects for adding to an image; these are always drawn relative to the current viewport.

```
R> grid.rect()
```

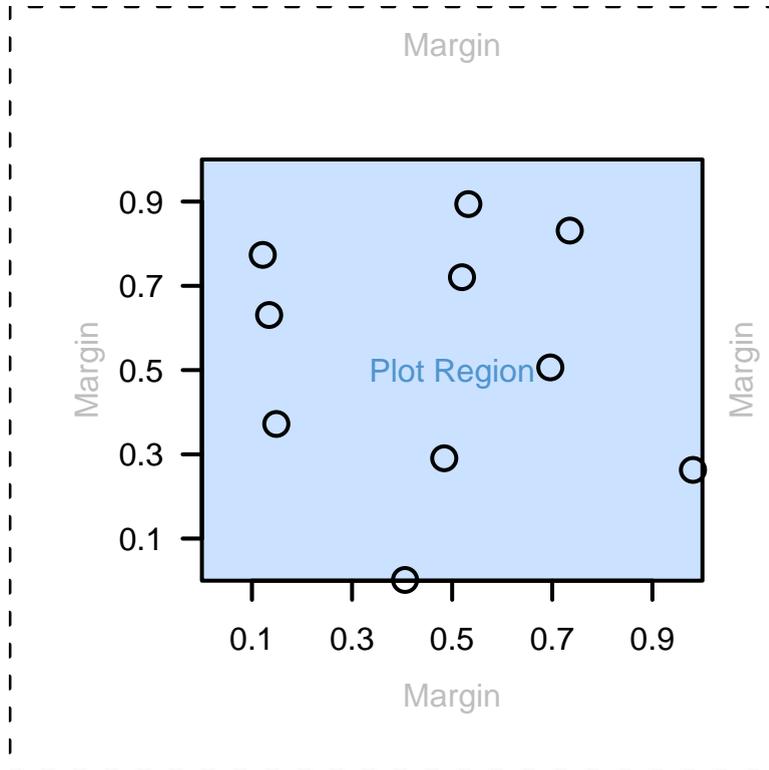
```
R> grid.xaxis(at=seq(.1, .9, length=5))
```

```
R> grid.yaxis(at=seq(.1, .9, length=5))
```

```
R> grid.points(x, y)
```



grid Graphical Objects



Back

Close

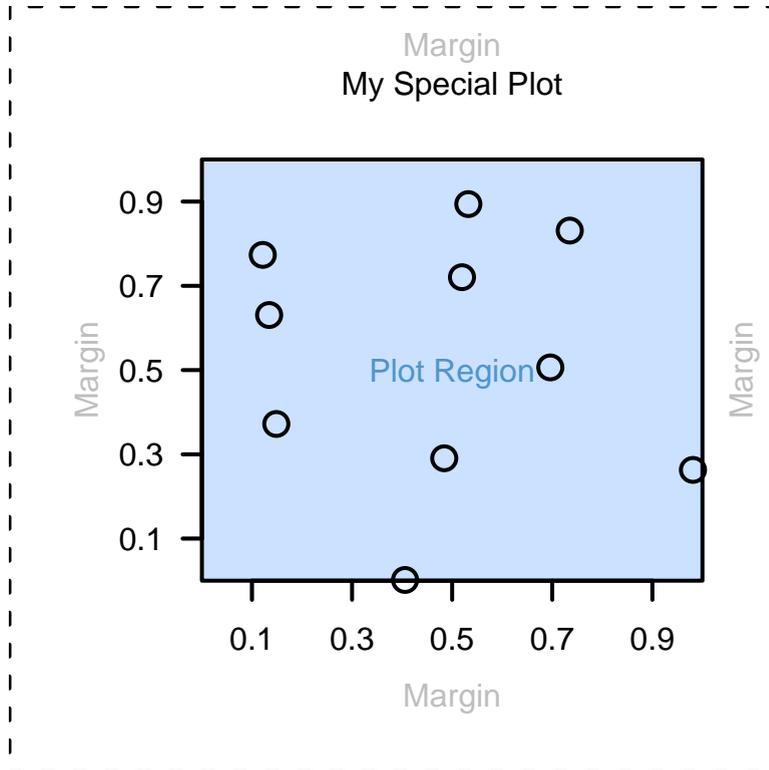
grid Units

- grid provides several coordinate systems within every viewport; unit objects associate a value with a particular coordinate system.

```
R> grid.text("My Special Plot",  
             y=unit(1, "npc") + unit(2, "lines"))
```



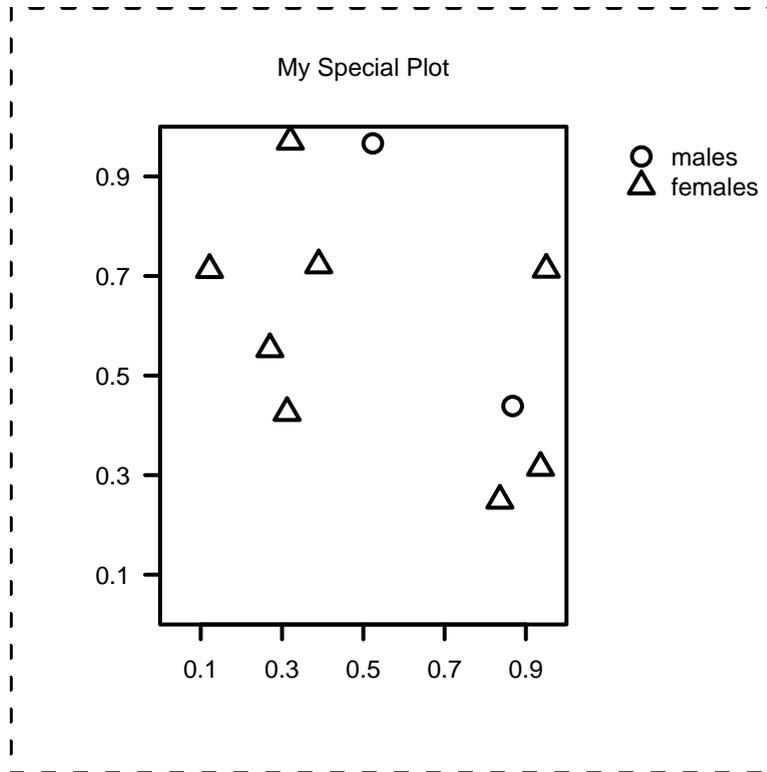
grid Units



Back

Close

A Developer Constructs a Legend



Back

Close

A Developer Constructs a Legend

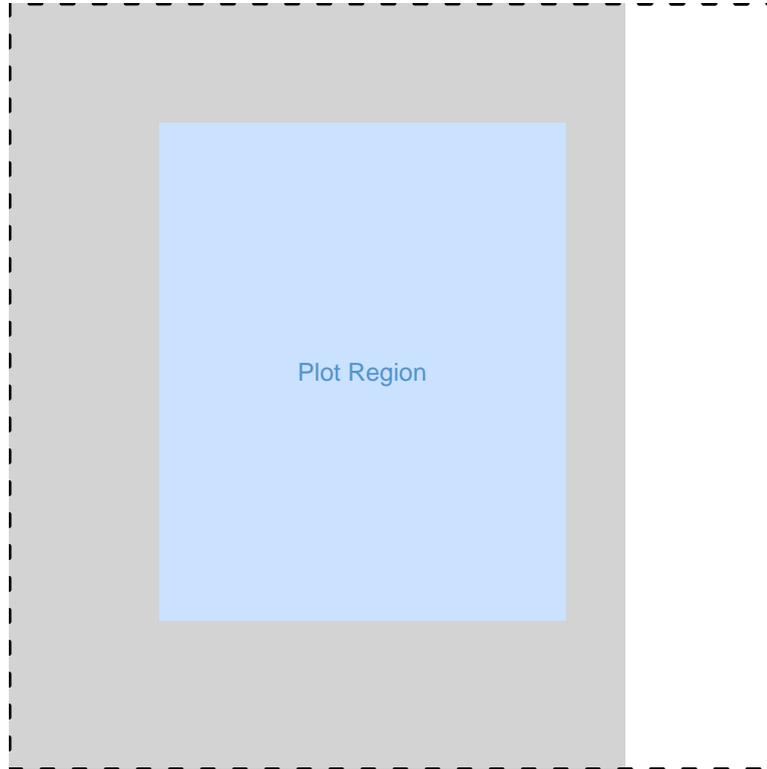
- grid viewports can be nested within each other.

```
R> push.viewport(viewport(x=0, width=0.8,  
                        just="left"))
```

```
R> push.viewport(plotViewport(c(5, 5, 4, 2)))
```



A Developer Constructs a Legend



Back

Close

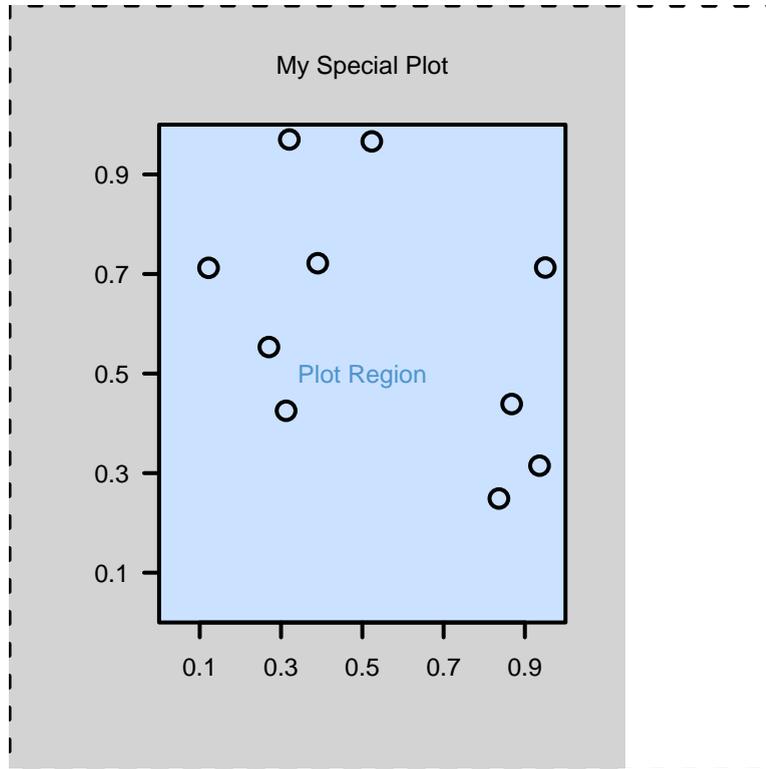
A Developer Constructs a Legend

- Drawing occurs within the current viewport.

```
R> grid.rect()
R> grid.xaxis(at=seq(.1, .9, length=5))
R> grid.yaxis(at=seq(.1, .9, length=5))
R> grid.points(x, y, pch=pch)
R> grid.text("My Special Plot",
            y=unit(1, "npc") + unit(2, "lines"))
```



A Developer Constructs a Legend



Back

Close

A Developer Constructs a Legend

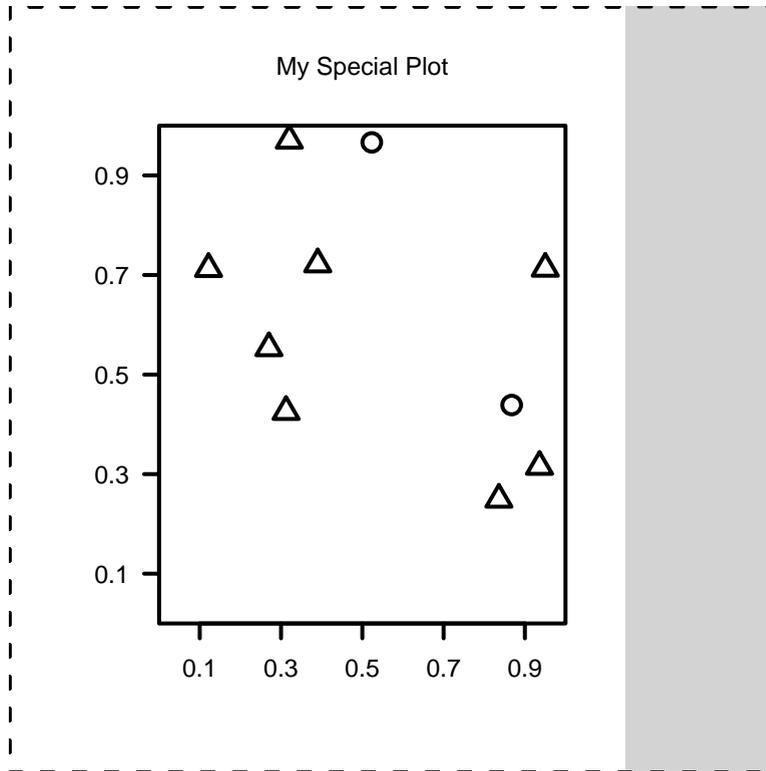
- For the legend we just set up a different viewport ...

```
R> pop.viewport()
```

```
R> push.viewport(viewport(x=1, width=0.2,  
                          just="right"))
```



A Developer Constructs a Legend



Back

Close

A Developer Constructs a Legend

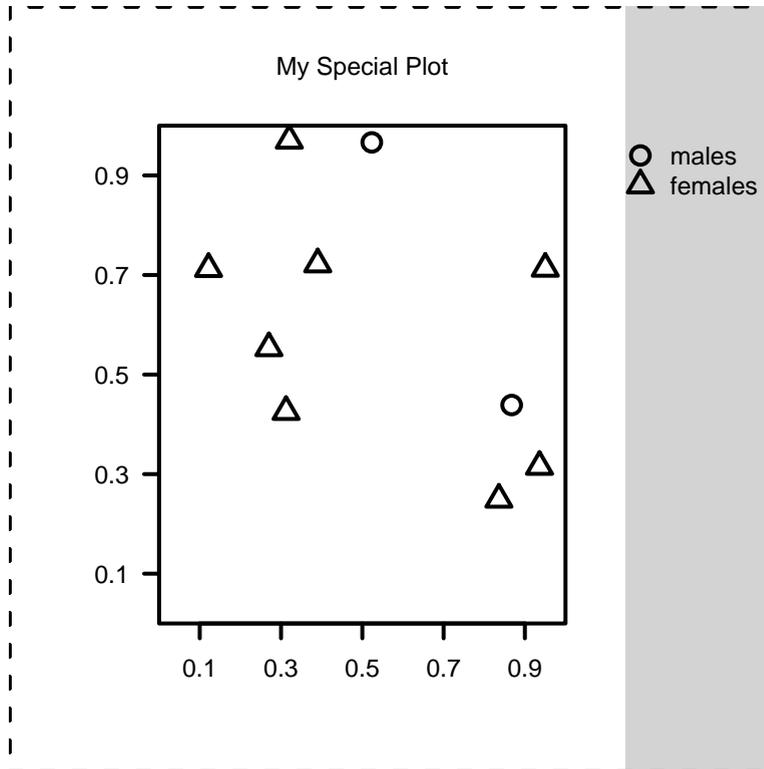
- ... and draw some data symbols and text.

```
R> grid.points(pch=1:2, x=unit(c(0.5, 0.5), "lines"),  
              y=unit(1, "npc") - unit(1:2, "lines"))
```

```
R> grid.text(c("males", "females"), just="left",  
            x=unit(c(1.5, 1.5), "lines"),  
            y=unit(1, "npc") - unit(1:2, "lines"))
```



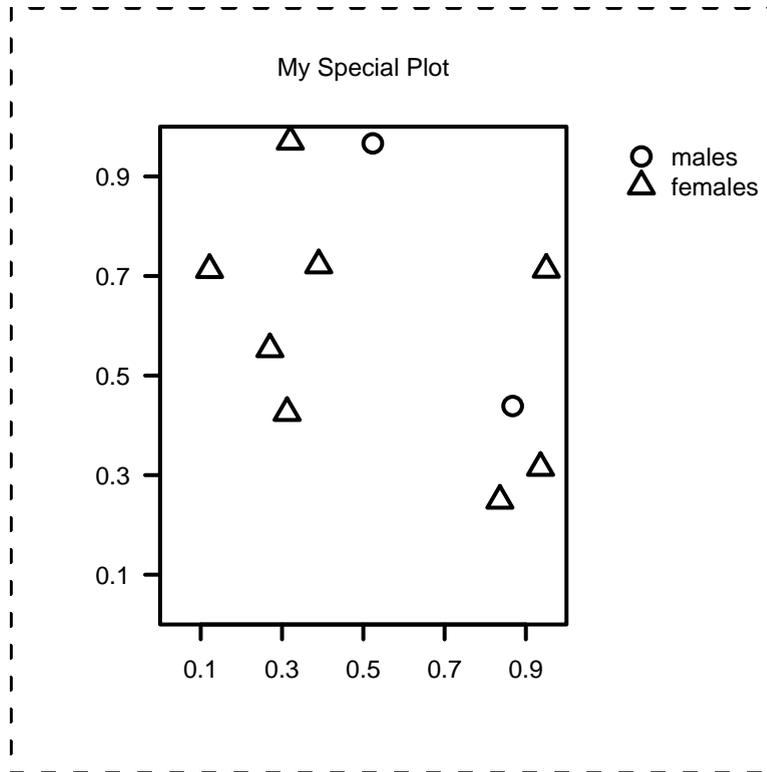
A Developer Constructs a Legend



Back

Close

A Developer Constructs a Legend



Back

Close

A Developer Gets Creative

The ozone2 Data Set

The response is 8-hour average (surface) ozone (from 9AM-4PM) measured in parts per billion (PPB) for 153 sites in the midwestern US over the period June 3, 1987 through August 31, 1987, 89 days.

Nychka, D., Cox, L., Piegorsch, W. (1998)

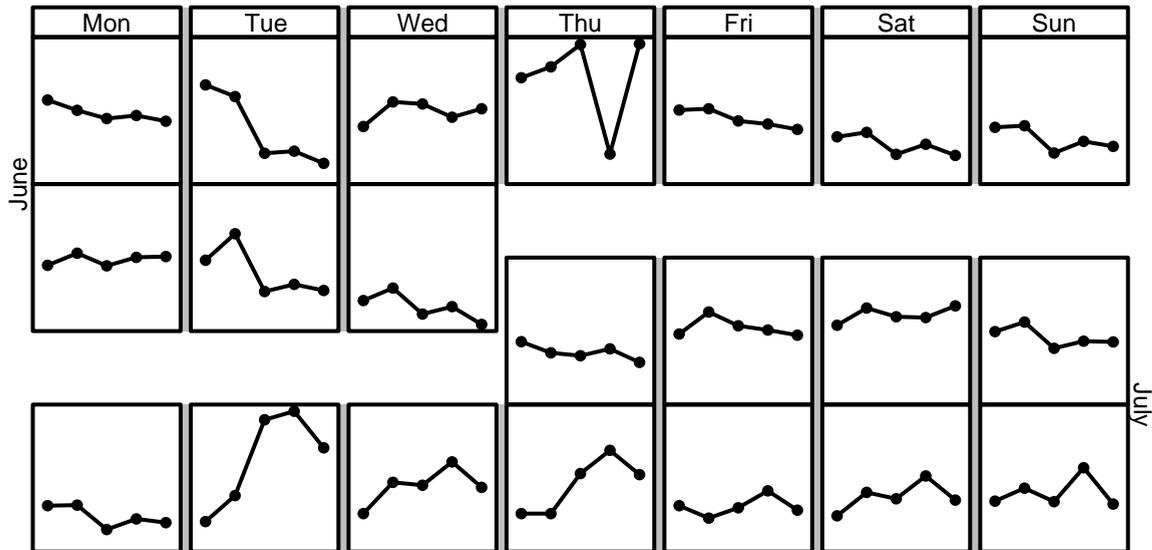
Case Studies in Environmental Statistics Lecture Notes in Statistics, Springer Verlag, New York



Back

Close

A Developer Gets Creative



Back

Close

A Developer Gets Creative

- First create a margin for labels

```
R> margin <- unit(1, "lines")
R> push.viewport(viewport(x=margin,
                           y=margin,
                           width=unit(1, "npc") - 2*margin,
                           height=unit(1, "npc") - 2*margin,
                           just=c("left", "bottom")))
```



A Developer Gets Creative



Back

Close

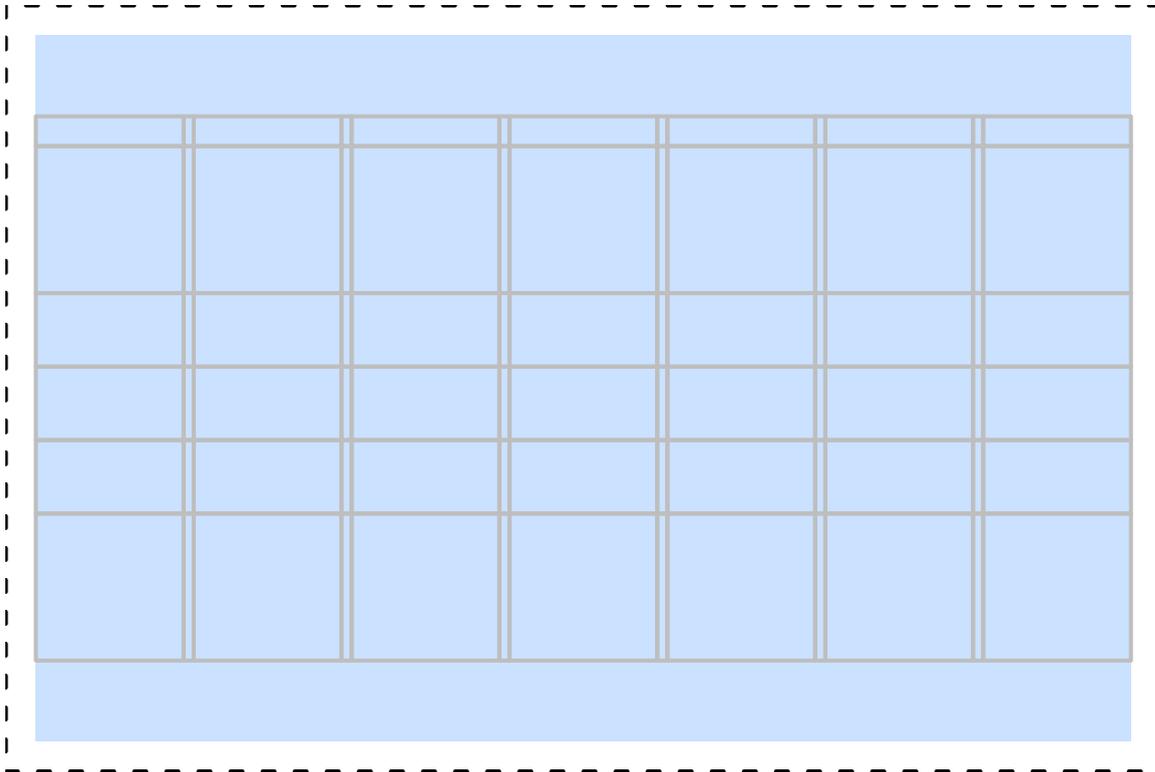
A Developer Gets Creative

- Now carve up the viewport into many different regions. Grid layouts are very useful for this sort of thing.

```
R> widths <- unit(c(1,2,1,2,1,2,1,2,1,2,1,2,1),
                  rep(c("null", "mm"), len=7))
R> heights <- unit(c(1, 1, 0.5, 0.5, 0.5, 1),
                  c("lines", rep("null", 5)))
R> push.viewport(
  viewport(
    layout=grid.layout(13, 6,
                       widths=widths,
                       heights=heights,
                       respect=TRUE)))
```



A Developer Gets Creative



Back

Close

A Developer Gets Creative

- Draw in a particular region by pushing a viewport that occupies that region.

```
R> push.viewport(viewport(layout.pos.row=1,  
                           layout.pos.col=1))
```

```
R> grid.rect()
```

```
R> grid.text("Mon")
```

```
R> pop.viewport()
```



A Developer Gets Creative

A calendar grid for Monday. The grid is light blue and enclosed in a dashed black border. The top-left cell contains the text "Mon". The grid consists of 7 columns and 6 rows. The first row is the header row, and the following five rows are the body of the calendar. The first cell of the first row is highlighted with a black border and contains the text "Mon".

Mon						



Back

Close

A Developer Gets Creative

- Draw in a particular region by pushing a viewport that occupies that region.

```
R> push.viewport(viewport(layout.pos.row=2,  
                           layout.pos.col=1))
```

```
R> push.viewport(datavp)
```

```
R> grid.rect()
```

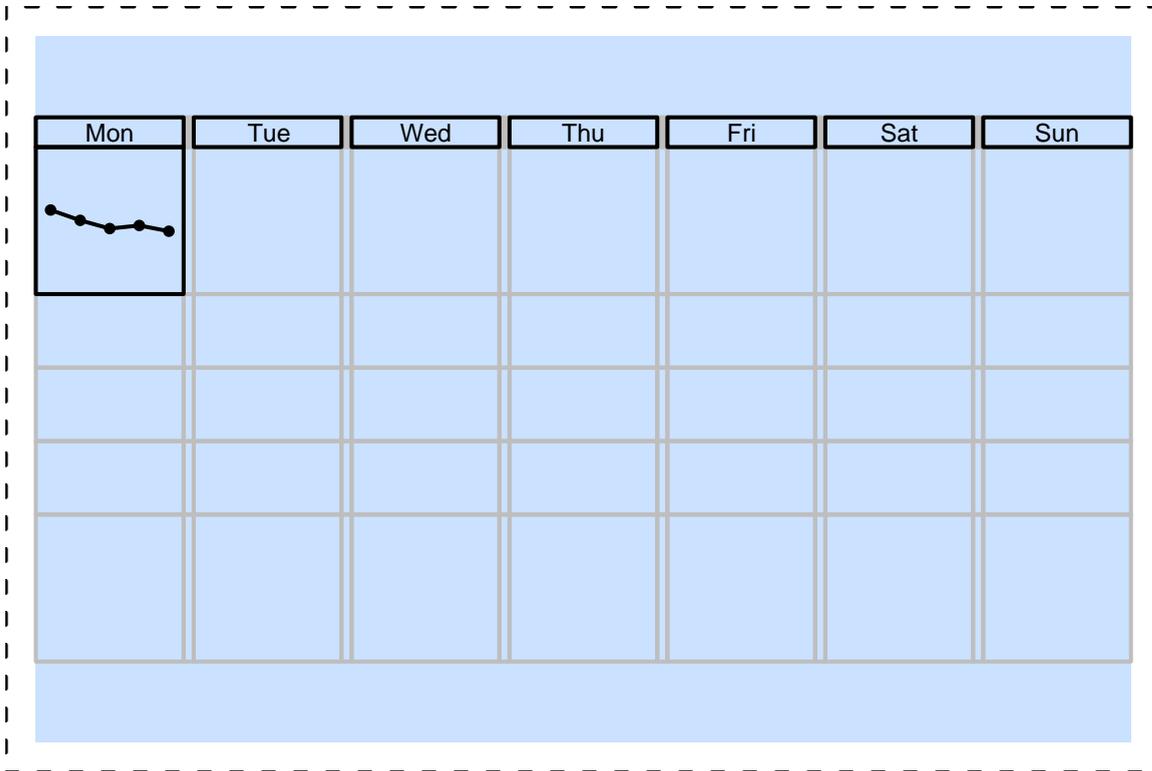
```
R> grid.lines(1:5, ozdata[1,], default="native")
```

```
R> grid.points(1:5, ozdata[1,],  
              pch=16, size=unit(2, "mm"))
```

```
R> pop.viewport(2)
```



A Developer Gets Creative



Back

Close

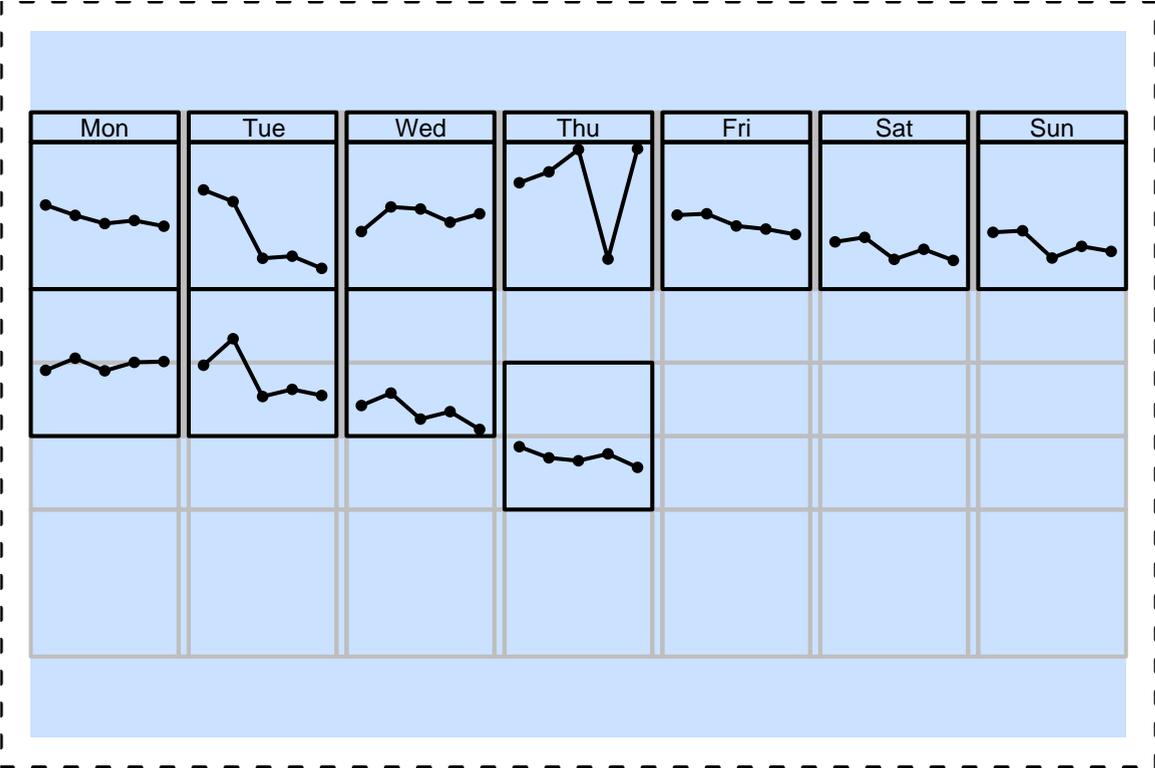
A Developer Gets Creative

- It is possible for a viewport to occupy a combination of several regions.

```
R> push.viewport(viewport(layout.pos.row=4:5,  
                           layout.pos.col=7))  
R> push.viewport(datavp)  
R> grid.rect()  
R> grid.lines(1:5, ozdata[11,], default="native")  
R> grid.points(1:5, ozdata[11,],  
              pch=16, size=unit(2, "mm"))  
R> pop.viewport(2)
```



A Developer Gets Creative



Back

Close

A Developer Gets Creative

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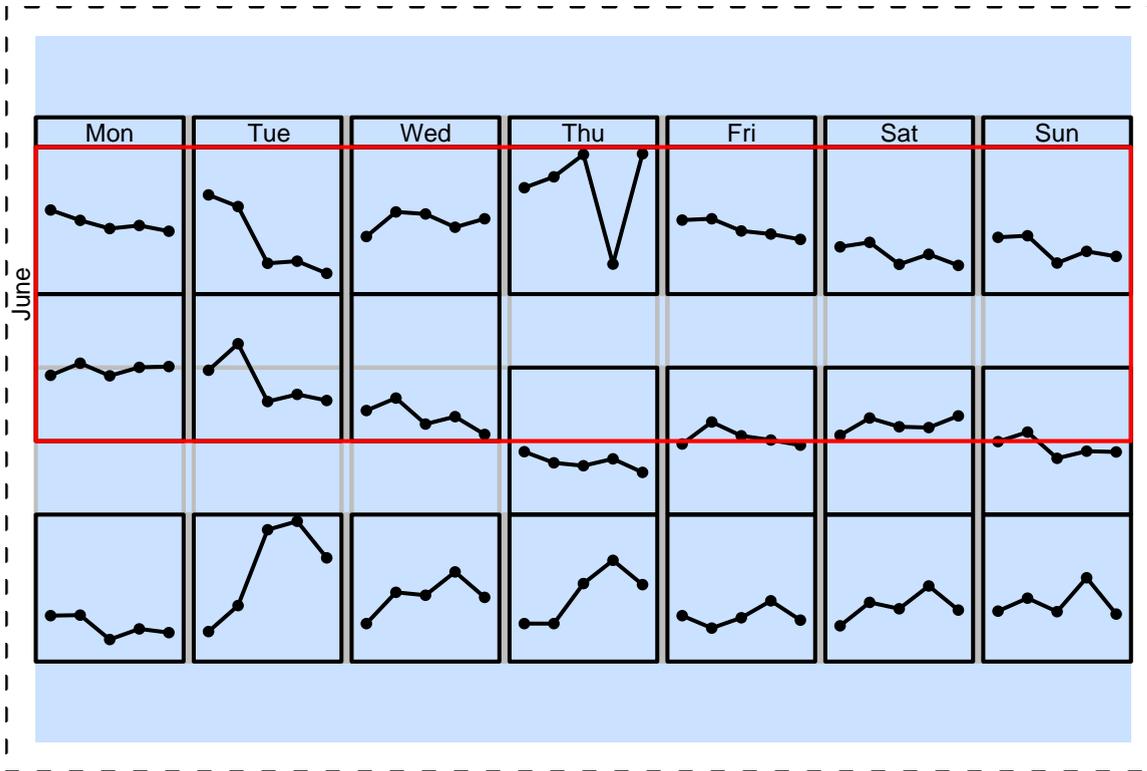
```
R> push.viewport(viewport(layout.pos.row=2:4))
```

```
R> grid.text("June", x=unit(-0.5, "lines"),  
             rot=90)
```

```
R> pop.viewport()
```



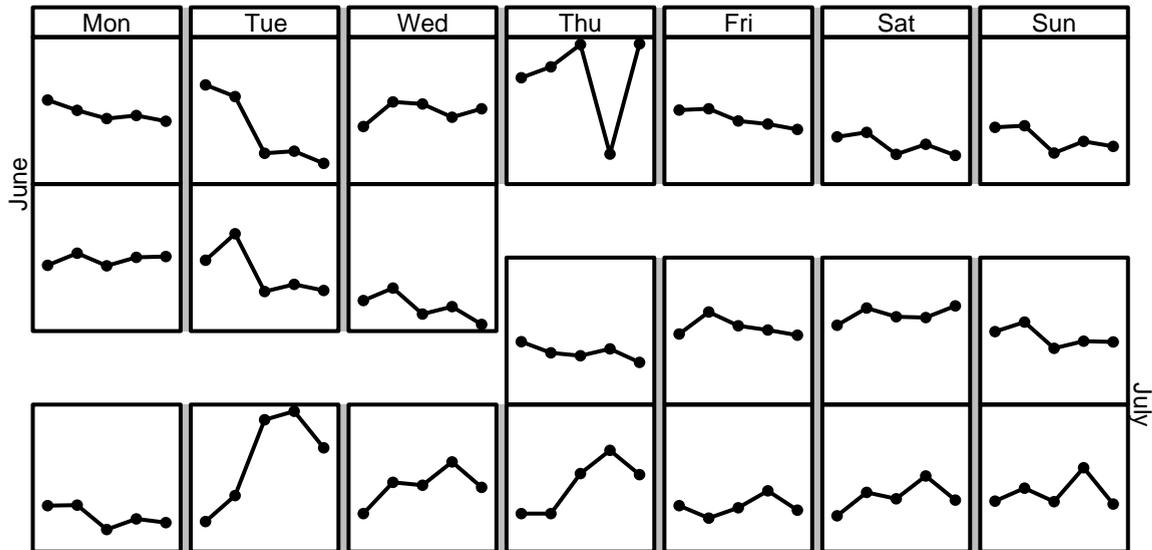
A Developer Gets Creative



Back

Close

A Developer Gets Creative



Back

Close

Other Stuff and Future Directions

- Rotated viewports
 - Frames and packing
 - Editing grid objects
 - grid locator
-
- Integration of `grid` and standard (“base”) graphics
 - More support for interactive graphics
 - Saving/restoring graphics



Back

Close

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Back

Close

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Back

Close

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Back

Close

Summary

- grid is an attempt at providing a framework in which graphical pieces are easy to access, combine, and manipulate.
- I do not want or expect all users to create all of their graphs from small pieces, but ...
 - ... I do want all users to be able to see the pieces that their graphs were created from and be able to add or modify the pieces as easily and coherently as possible and ...
 - ... it would be nice if some users created some of their graphs from small pieces some of the time; I think we would see more interesting and more illuminating graphs as a result.



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