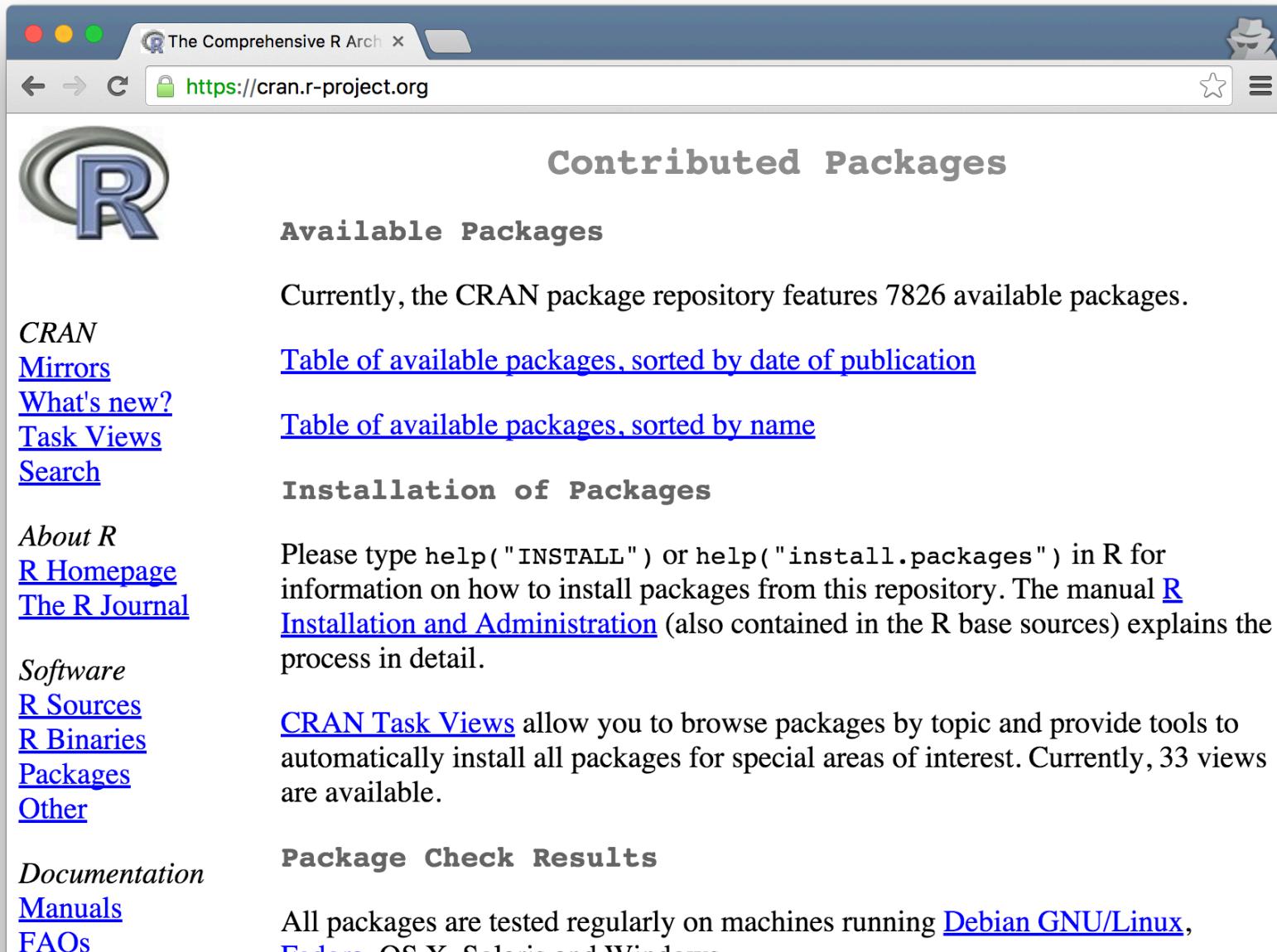


Extending R through packages:
There's a package for everything

R packages are available on CRAN (Comprehensive R Archive Network)



The screenshot shows a web browser window with the title bar "The Comprehensive R Arch". The address bar displays the URL "https://cran.r-project.org". The page content is titled "Contributed Packages". On the left side, there is a large "R" logo inside a circle. Below the logo, there is a sidebar with links: "CRAN", "Mirrors", "What's new?", "Task Views", and "Search". Under "About R", there are links to "R Homepage" and "The R Journal". Under "Software", there are links to "R Sources", "R Binaries", "Packages", and "Other". Under "Documentation", there are links to "Manuals" and "FAQs". The main content area has sections for "Available Packages" (mentioning 7826 packages), "Installation of Packages" (with instructions to use R functions like "help('INSTALL')"), and "Package Check Results" (mentioning regular testing on Debian GNU/Linux, Fedora, OS X, Solaris, and Windows).

Contributed Packages

Available Packages

Currently, the CRAN package repository features 7826 available packages.

[Table of available packages, sorted by date of publication](#)

[Table of available packages, sorted by name](#)

Installation of Packages

Please type `help("INSTALL")` or `help("install.packages")` in R for information on how to install packages from this repository. The manual [R Installation and Administration](#) (also contained in the R base sources) explains the process in detail.

[CRAN Task Views](#) allow you to browse packages by topic and provide tools to automatically install all packages for special areas of interest. Currently, 33 views are available.

Package Check Results

All packages are tested regularly on machines running [Debian GNU/Linux](#), [Fedora](#), [OS X](#), [Solaris](#) and [Windows](#).

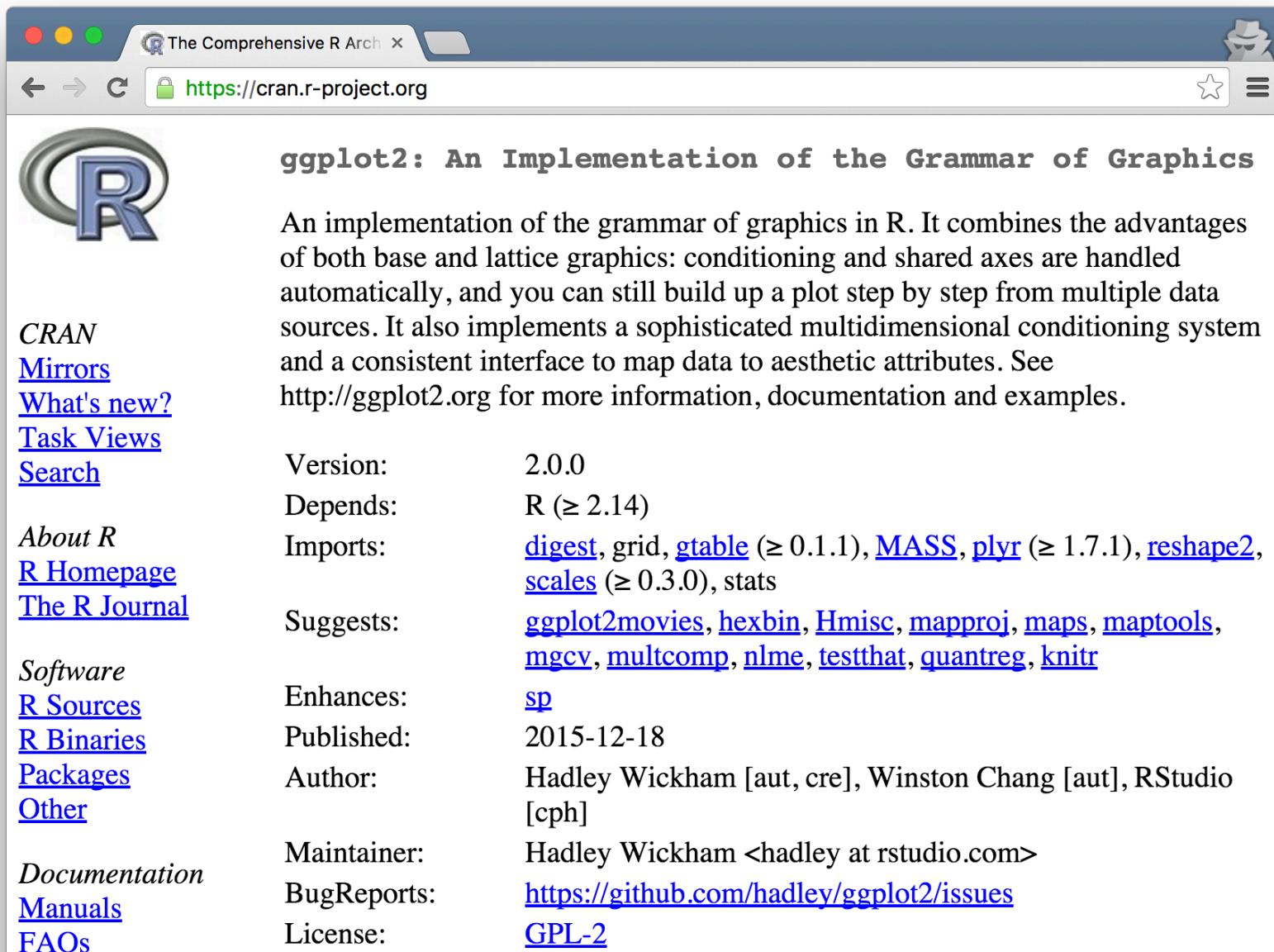
R packages are available on CRAN (Comprehensive R Archive Network)



The screenshot shows a web browser window with the title bar "The Comprehensive R Arch" and the URL "https://cran.r-project.org". The page content is titled "Available CRAN Packages By Name" and lists packages grouped by letter: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z. On the left sidebar, there are links for CRAN, Mirrors, What's new?, Task Views, Search, About R, R Homepage, and The R Journal. Under Software, there are links for R Sources, R Binaries, Packages, and Other. Under Documentation, there are links for Manuals and FAQs.

Available CRAN Packages By Name	
	A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
<i>CRAN</i>	A3
Mirrors	abbyyR
What's new?	abc
Task Views	ABCanalysis
Search	abc.data
<i>About R</i>	abcdeFBA
R Homepage	ABCOptim
The R Journal	abcrf
<i>Software</i>	abctools
R Sources	abd
R Binaries	abc
Packages	ABC
Other	ABCAnalysis
<i>Documentation</i>	ABCoptim
Manuals	ABC
FAQs	ABC

We'll be working with the package `ggplot2`



The screenshot shows a web browser window with the title "The Comprehensive R Arch" and the URL "https://cran.r-project.org". The main content is the CRAN package page for "ggplot2: An Implementation of the Grammar of Graphics". The page includes the R logo, navigation links for CRAN, mirrors, and task views, and sections for About R, Software, Documentation, and Manuals. The package details section provides information such as Version (2.0.0), Depends (R >= 2.14), Imports (digest, grid, gtable, MASS, plyr, reshape2, scales, stats), Suggests (ggplot2movies, hexbin, Hmisc, mapproj, maps, maptools, mgcv, multcomp, nlme, testthat, quantreg, knitr), Enhances (sp), Published (2015-12-18), Author (Hadley Wickham [aut, cre], Winston Chang [aut], RStudio [cph]), Maintainer (Hadley Wickham <hadley at rstudio.com>), BugReports (<https://github.com/hadley/ggplot2/issues>), and License (GPL-2).

ggplot2: An Implementation of the Grammar of Graphics

An implementation of the grammar of graphics in R. It combines the advantages of both base and lattice graphics: conditioning and shared axes are handled automatically, and you can still build up a plot step by step from multiple data sources. It also implements a sophisticated multidimensional conditioning system and a consistent interface to map data to aesthetic attributes. See <http://ggplot2.org> for more information, documentation and examples.

Version:	2.0.0
Depends:	R (>= 2.14)
Imports:	digest , grid , gtable (>= 0.1.1), MASS , plyr (>= 1.7.1), reshape2 , scales (>= 0.3.0), stats
Suggests:	ggplot2movies , hexbin , Hmisc , mapproj , maps , maptools , mgcv , multcomp , nlme , testthat , quantreg , knitr
Enhances:	sp
Published:	2015-12-18
Author:	Hadley Wickham [aut, cre], Winston Chang [aut], RStudio [cph]
Maintainer:	Hadley Wickham <hadley at rstudio.com>
BugReports:	https://github.com/hadley/ggplot2/issues
License:	GPL-2

You can install this package using install.packages() in RStudio

```
Console ~/ ↗
Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> install.packages("ggplot2") 
% Total % Received % Xferd Average Speed Time Time Time Current
          Dload Upload Total Spent Left Speed
0      0    0      0      0      0      0 --:--:-- --:--:-- --:--:-- 0 38 1932k
38 751k  0      0  1529k      0  0:00:01 --:--:-- 0:00:01 1527k 100 1932k
0      0  2918k      0 --:--:-- --:--:-- 2918k

The downloaded binary packages are in
/var/folders/q8/wptgtbdn1pz0cfgrz39gq00m0000gn/T//RtmpvQgw1u/downloaded_packages
> |
```

ggplot2: A grammar of graphics

Traditional plotting: You **are** a painter

- Manually place individual graphical elements

ggplot2: You **employ** a painter

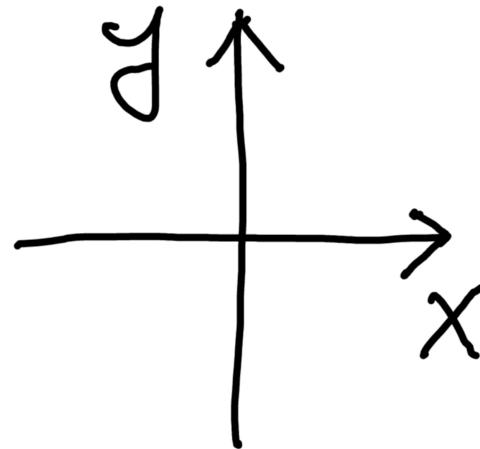
- Describe conceptually how data should be visualized

Most confusing key concept: aesthetic mapping

Maps data values to visual elements of the plot

A few examples of aesthetics

position



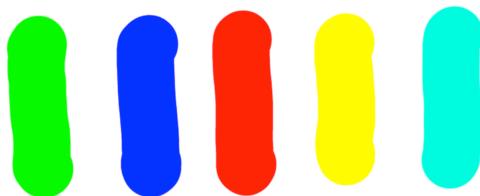
shape



size



color



angle



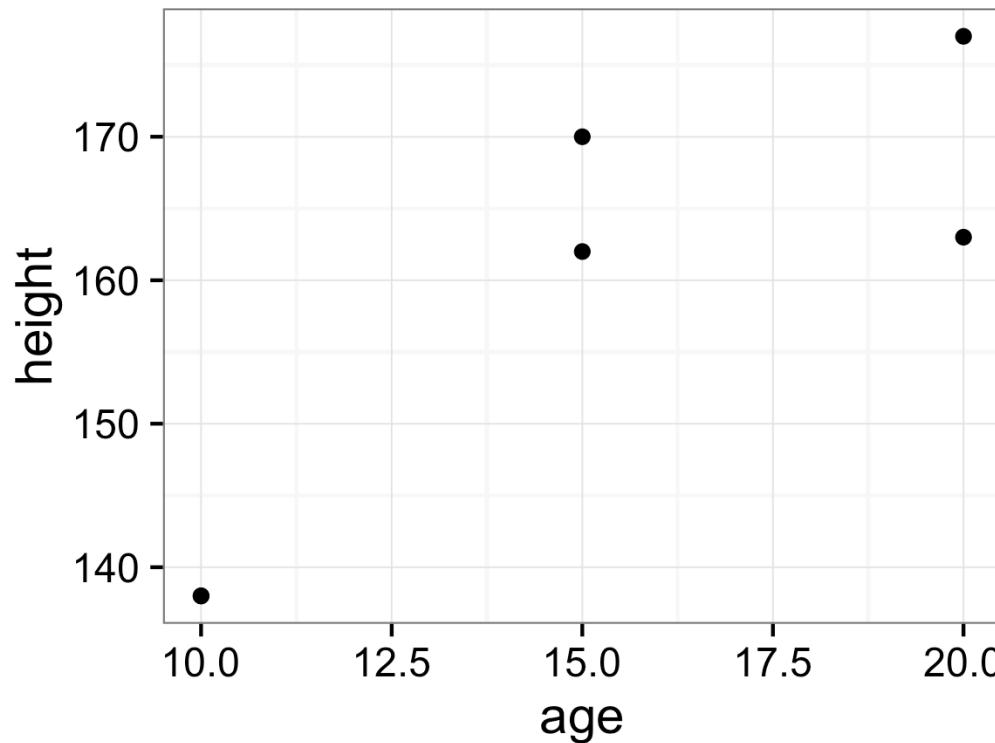
Let's go over a simple example: mean height and weight of boys/girls ages 10-20

age (yrs)	height (cm)	weight (kg)	sex
10	138	32	M
15	170	56	M
20	177	71	M
10	138	33	F
15	162	52	F
20	163	53	F

Data from: <http://www.cdc.gov/growthcharts/>

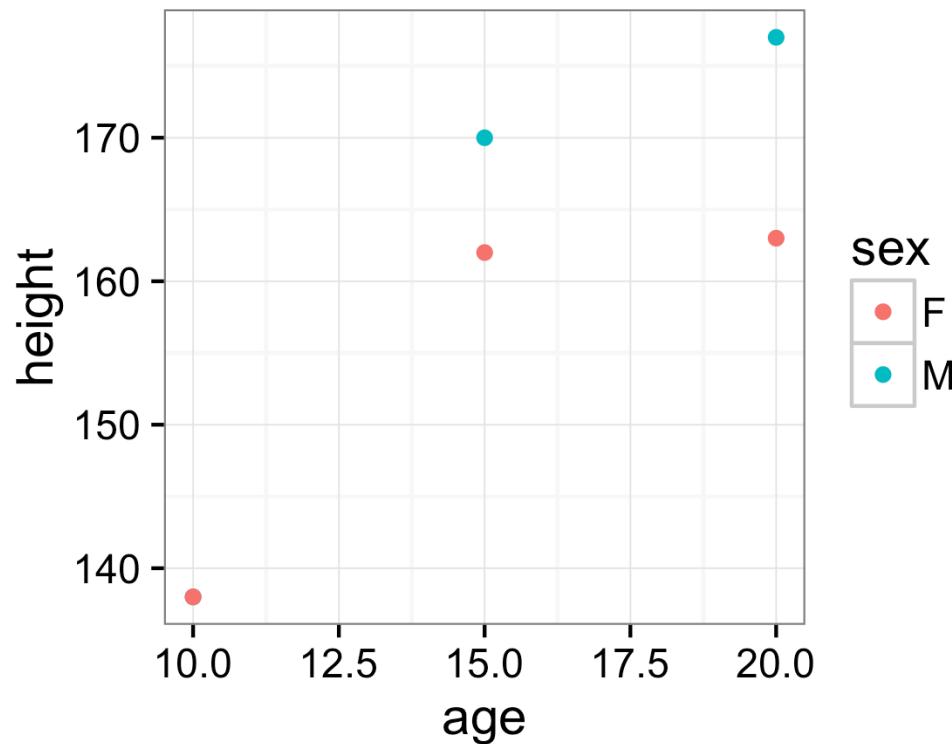
Map age to x, height to y, visualize using points

```
ggplot(data, aes(x=age, y=height)) +  
  geom_point()
```



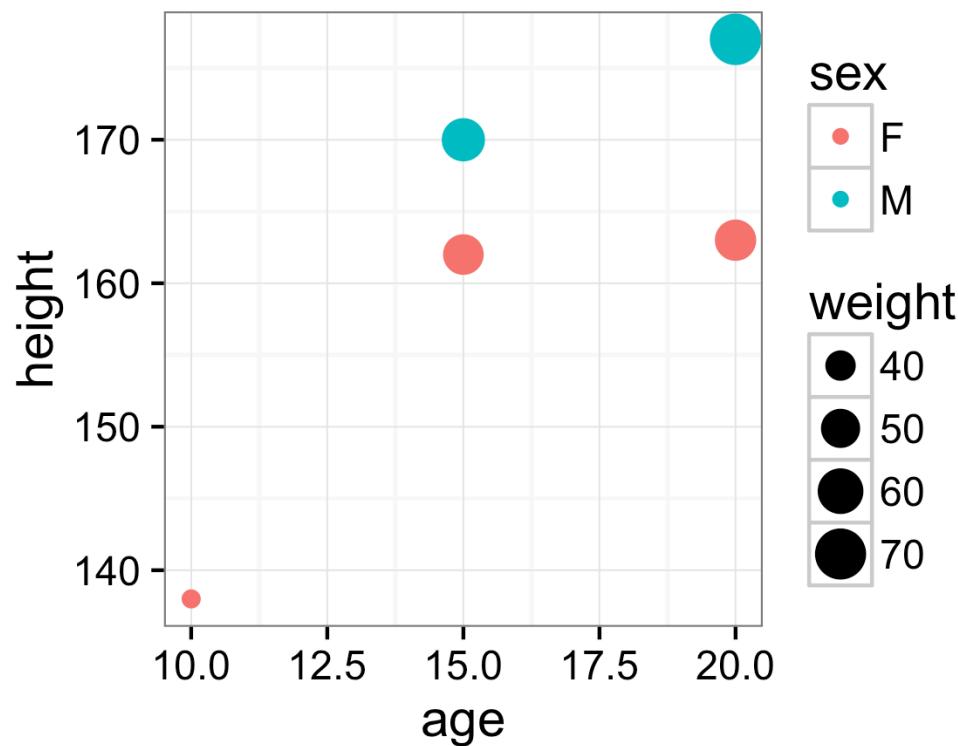
Let's color the points by sex

```
ggplot(data, aes(x=age, y=height,  
                  color=sex)) + geom_point()
```



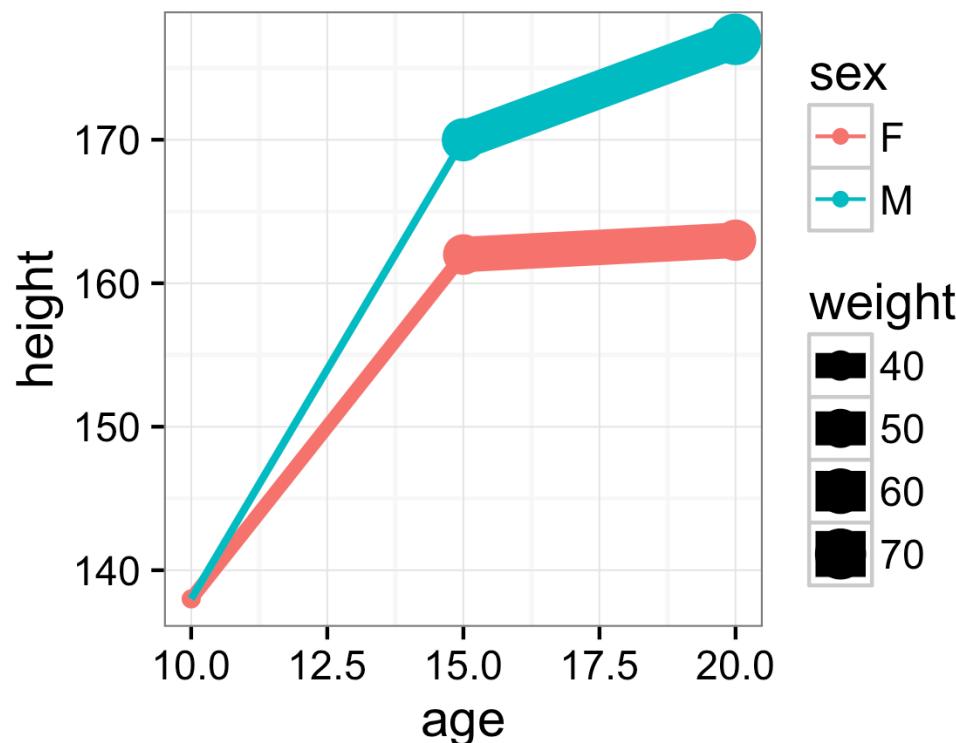
And change point size by weight

```
ggplot(data, aes(x=age, y=height,  
color=sex, size=weight)) + geom_point()
```



And connect the points with lines

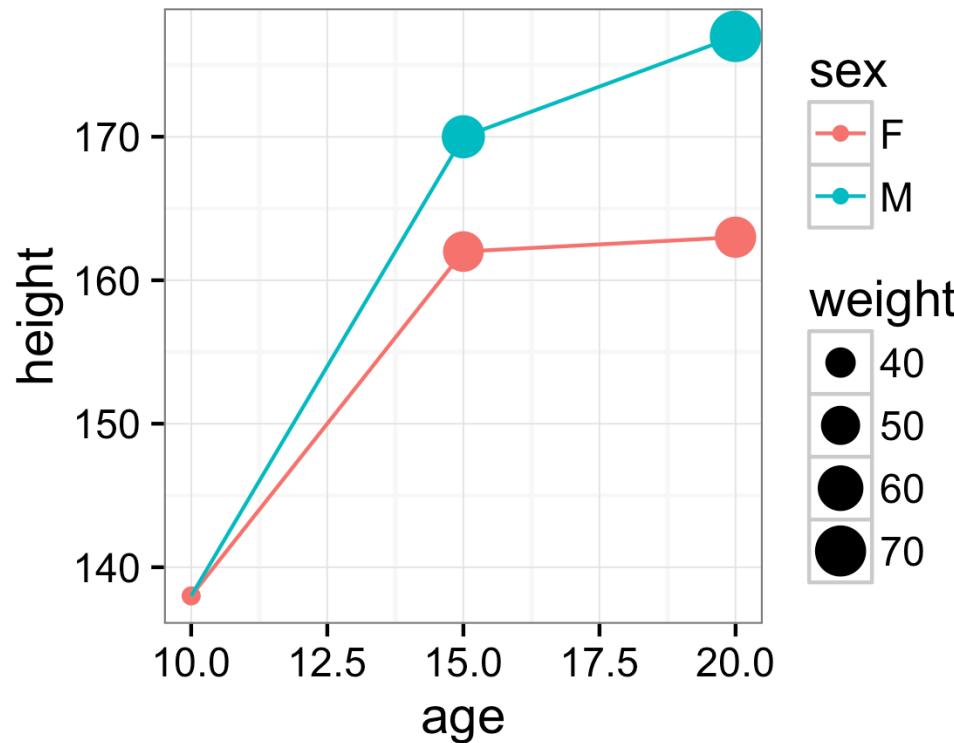
```
ggplot(data, aes(x=age, y=height,  
color=sex, size=weight)) +  
  geom_point() + geom_line()
```



Oops!

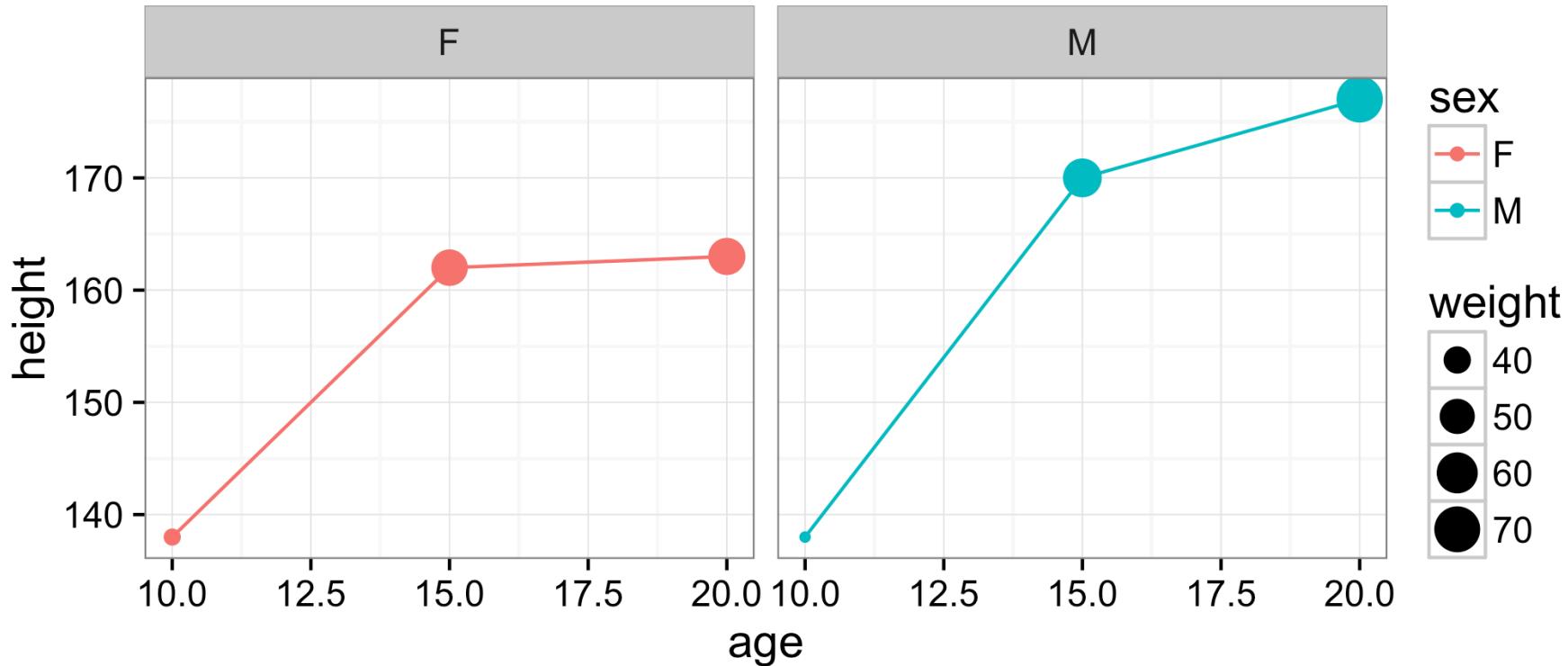
The weight-to-size mapping should only be applied to points

```
ggplot(data, aes(x=age, y=height,  
color=sex)) + geom_point(aes(size=weight)) +  
geom_line()
```



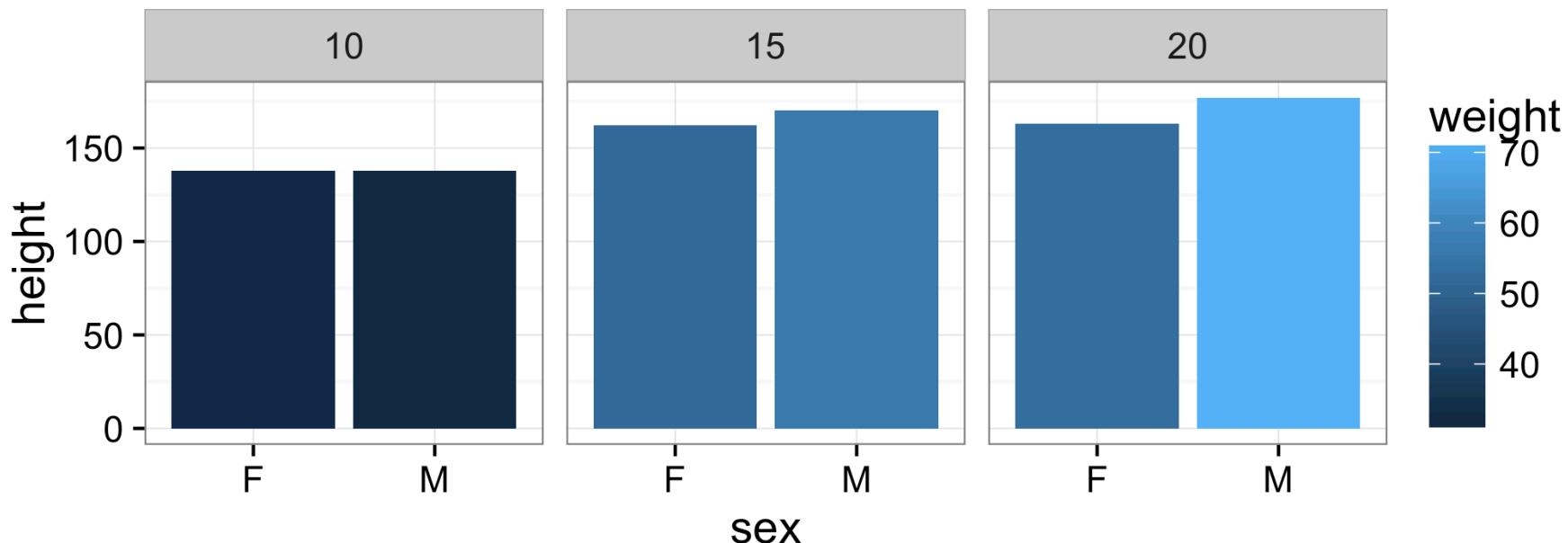
We can also make side-by-side plots (called facets)

```
ggplot(data, aes(x=age, y=height,  
color=sex)) + geom_point(aes(size=weight)) +  
geom_line() + facet_wrap(~sex)
```



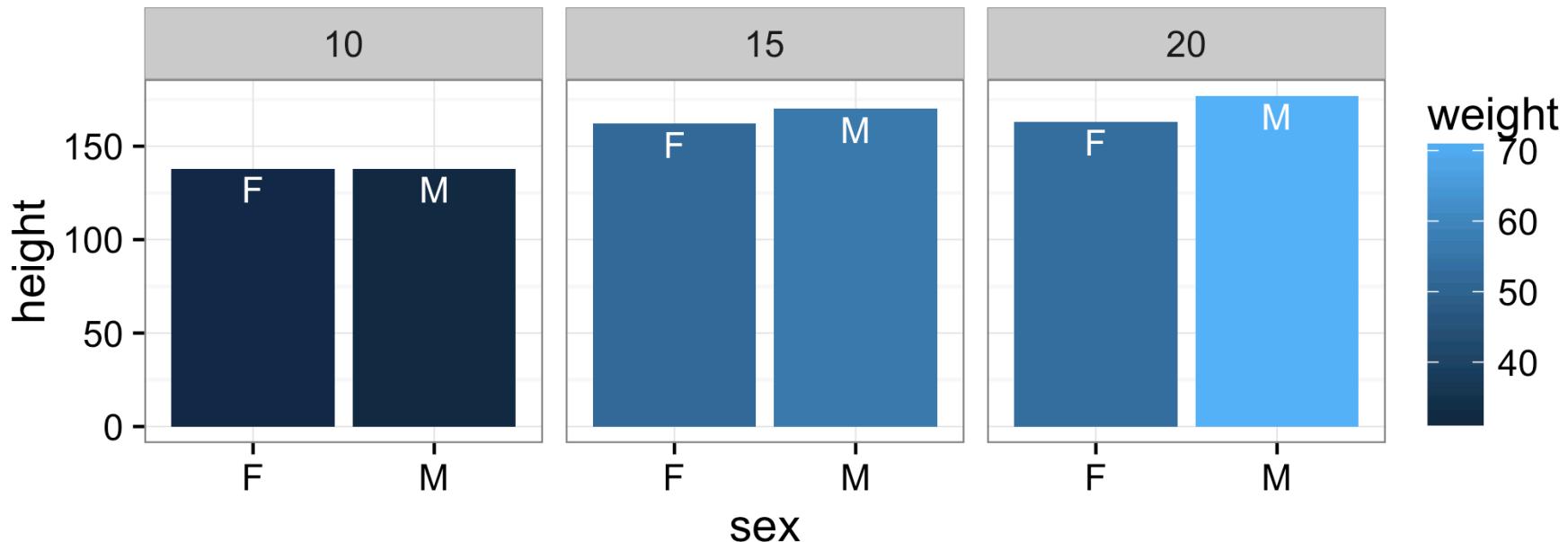
Now let's facet by age, color by weight, and use bars to plot height

```
ggplot(data, aes(x=sex, y=height,  
fill=weight)) + geom_bar(stat='identity') +  
facet_wrap(~age)
```



Let's plot the sex also at the top of the bar

```
ggplot(data, aes(x=sex, y=height, fill=weight)) +  
  geom_bar(stat='identity') +  
  geom_text(aes(label=sex), vjust=1.3, color='white') +  
  facet_wrap(~age)
```



All the geom's with all their options are described on the ggplot2 web page

<http://docs.ggplot2.org/current/>