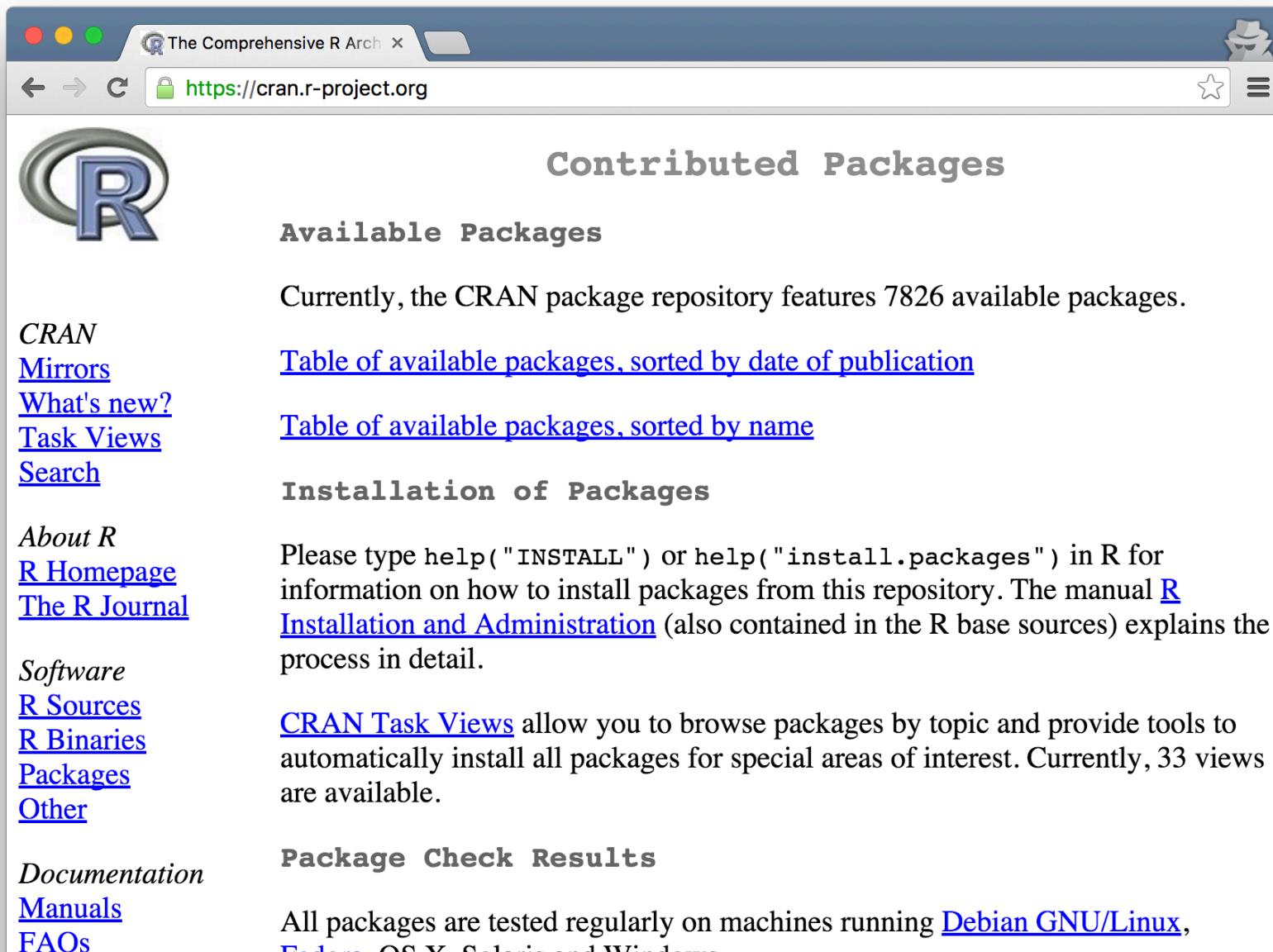


Extending R through packages:
There's a package for everything

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" and features a large "R" logo. It includes sections for "Available Packages" (mentioning 7826 packages), "Installation of Packages" (with instructions to use R functions like "help('INSTALL')"), and "CRAN Task Views" (describing 33 available views). Other navigation links on the left include "CRAN", "Mirrors", "What's new?", "Task Views", "Search", "About R", "R Homepage", "The R Journal", "Software", "R Sources", "R Binaries", "Packages", "Other", and "Documentation".

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](#).

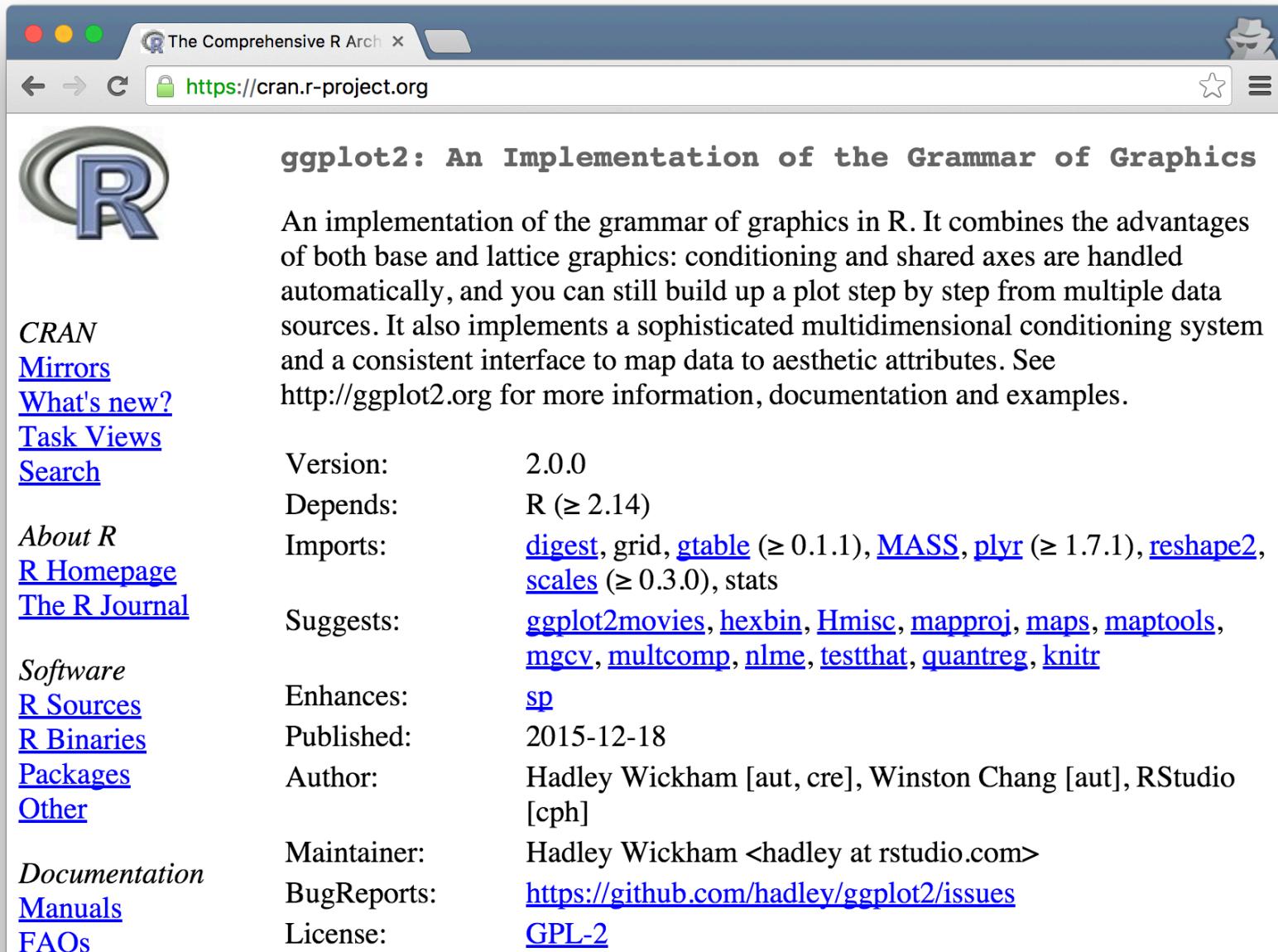
R packages are available on CRAN (Comprehensive R Archive Network)



The screenshot shows a web browser window with the title "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 from A to Z. On the left, there's a sidebar with links for CRAN, Mirrors, What's new?, Task Views, Search, About R, R Homepage, and The R Journal. Below that is a "Software" section with links for R Sources, R Binaries, Packages, and Other. At the bottom is a "Documentation" section with links for Manuals and FAQs.

	Available CRAN Packages By Name	
<i>CRAN</i>	A3	Accurate, Adaptable, and Accessible Error Metrics for Predictive Models
Mirrors	abbyyR	Access to Abbyy Optical Character Recognition (OCR) API
What's new?	abc	Tools for Approximate Bayesian Computation (ABC)
Task Views	ABCanalysis	Computed ABC Analysis
Search	abc.data	Data Only: Tools for Approximate Bayesian Computation (ABC)
<i>About R</i>	abcdeFBA	ABCDE_FBA: A-Biologist-Can-Do-Everything of Flux Balance Analysis with this package
R Homepage	ABCOptim	Implementation of Artificial Bee Colony (ABC) Optimization
The R Journal	abcrf	Approximate Bayesian Computation via Random Forests
<i>Software</i>	abctools	Tools for ABC Analyses
R Sources	abd	The Analysis of Biological Data
R Binaries	abc	Load Gen-Easy Axon ARF2 Files
Packages		
Other		
<i>Documentation</i>		
Manuals		
FAQs		

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". On the left, there's a sidebar with links for CRAN, Mirrors, What's new?, Task Views, Search, About R, R Homepage, and The R Journal. Below that are links for Software, R Sources, R Binaries, Packages, and Other. At the bottom are links for Documentation, Manuals, and FAQs. The right side of the page contains detailed information about the ggplot2 package, including its version (2.0.0), dependencies (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 date (2015-12-18), author (Hadley Wickham [aut, cre], Winston Chang [aut], RStudio [cph]), maintainer (Hadley Wickham <hadley at rstudio.com>), bug reports (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

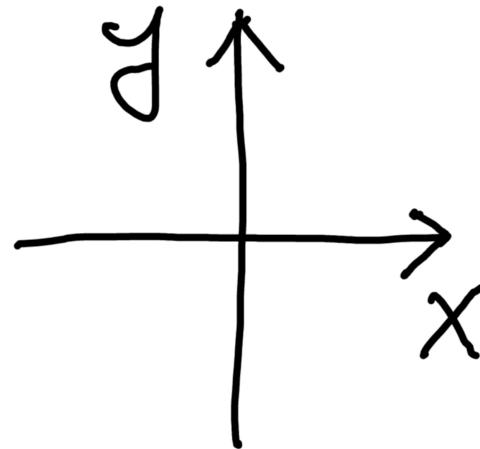
- Describe conceptually how data should be visualized

Most confusing key concept: aesthetic mapping

Maps data values to visual elements of the plot

A few examples of aesthetics

position



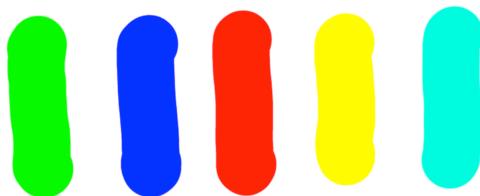
shape



size



color



angle



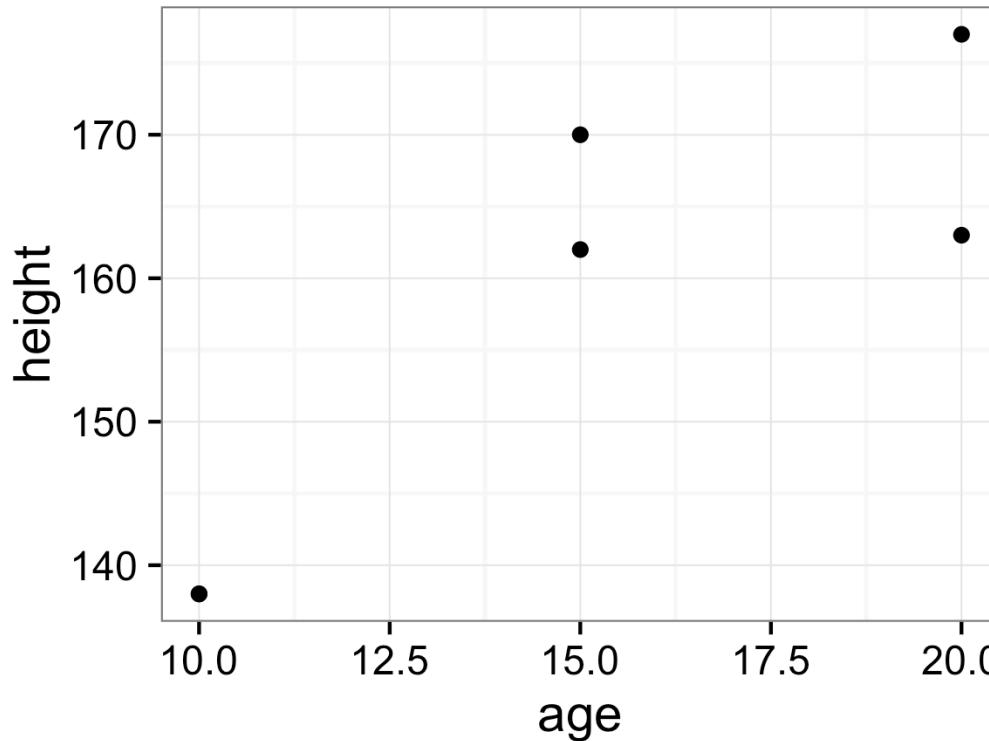
Let's go over a simple example: mean height and weight of boys/girls ages 10-20

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/>

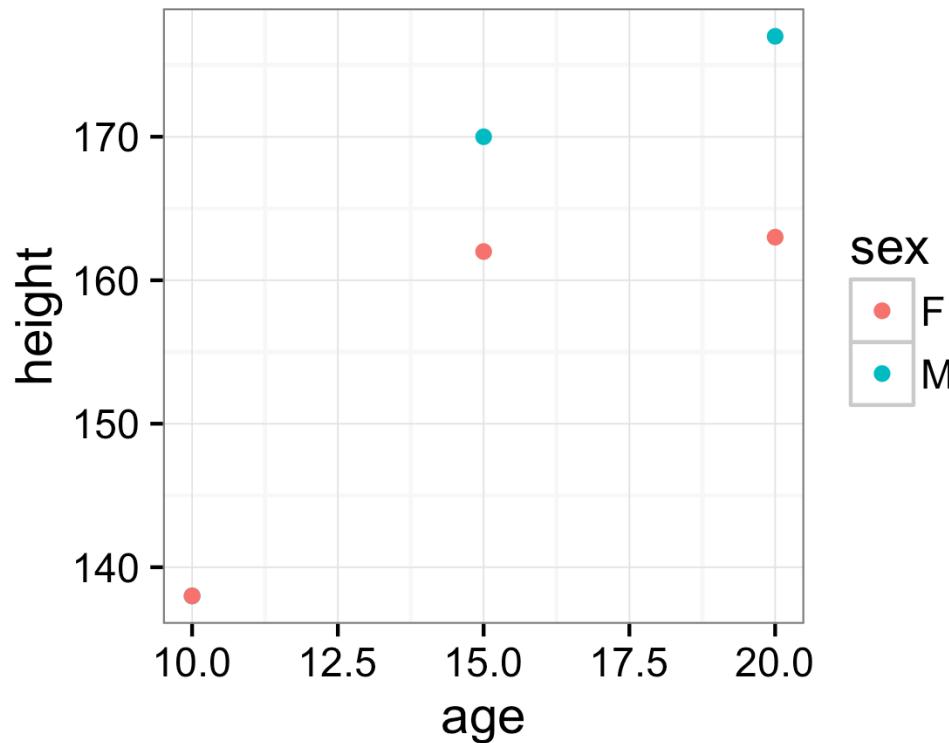
Map age to x, height to y, visualize using points

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



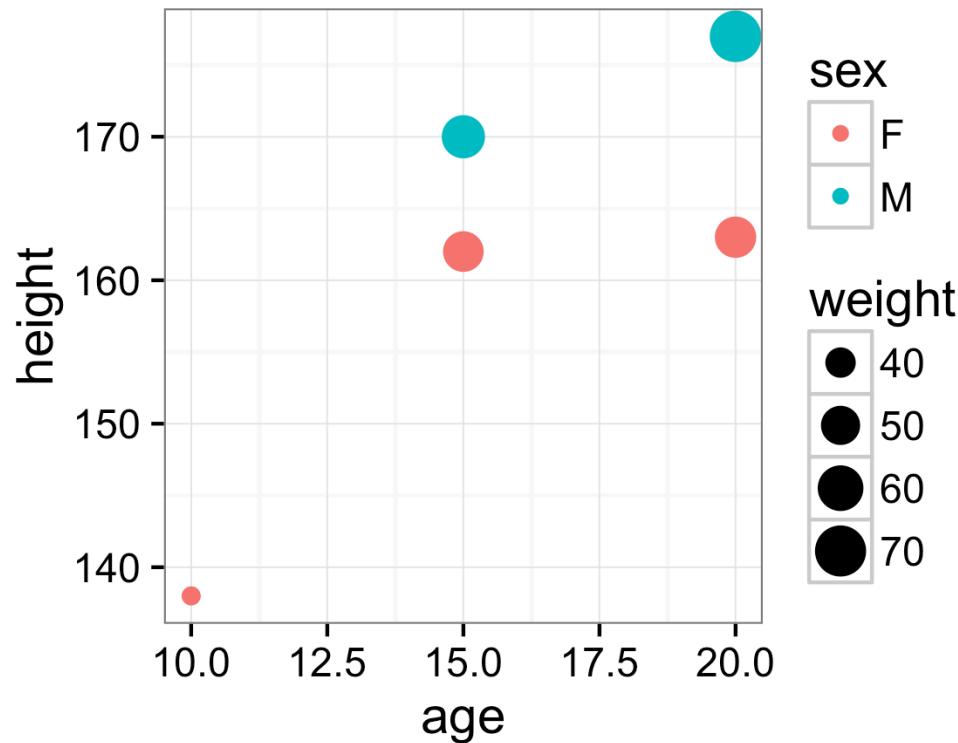
Let's color the points by sex

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



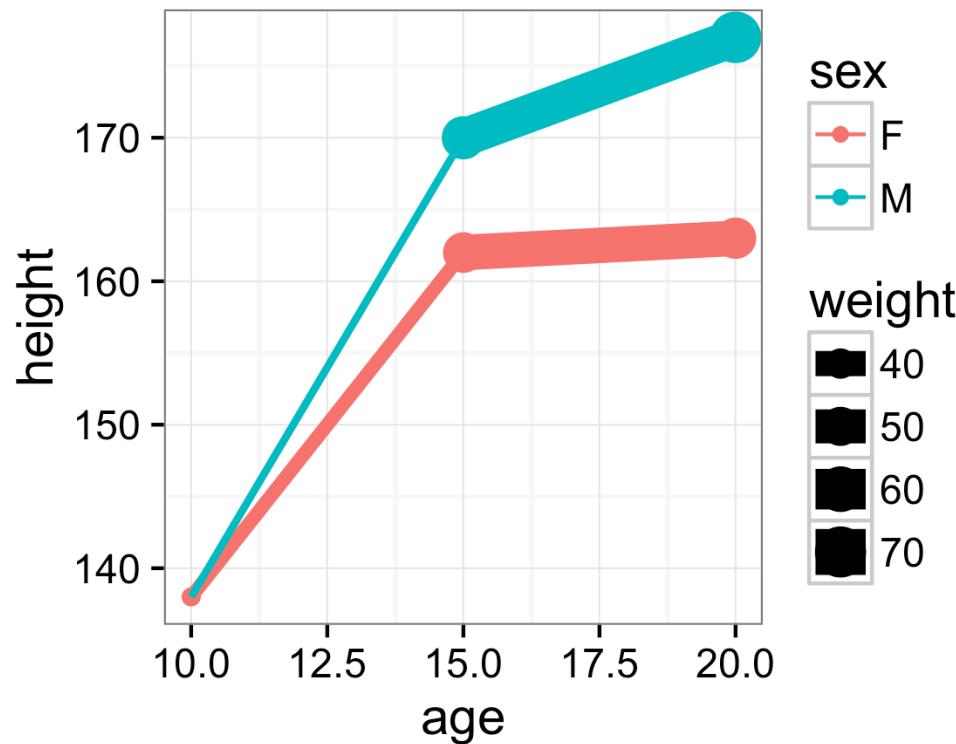
And change point size by weight

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



And connect the points with lines

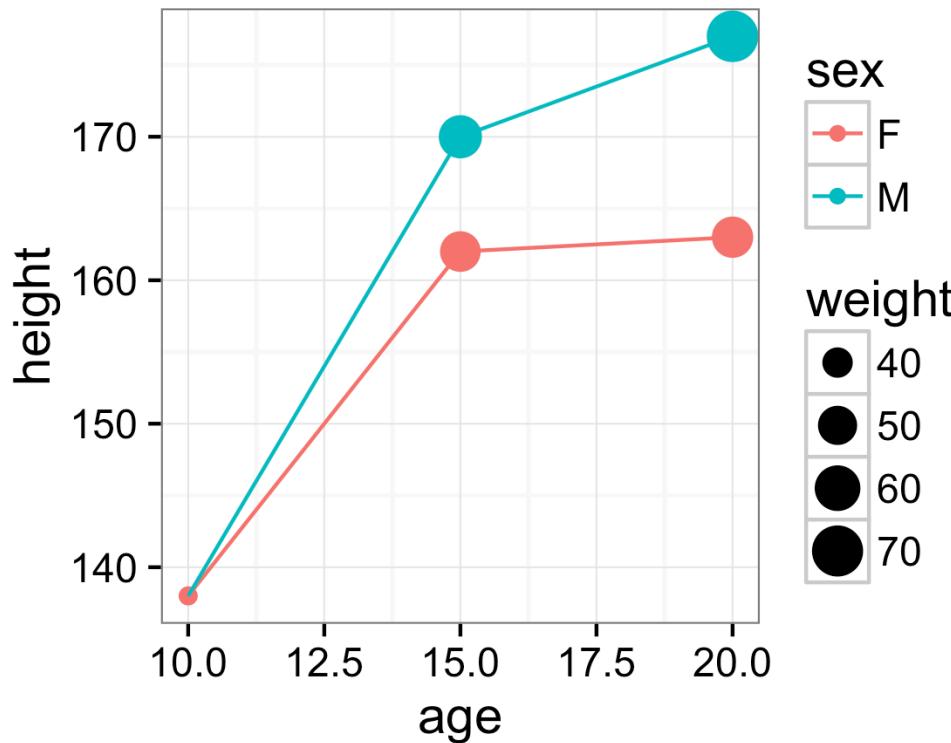
```
ggplot(data, aes(x=age, y=height,  
color=sex, size=weight)) +  
  geom_point() + geom_line()
```



Oops!

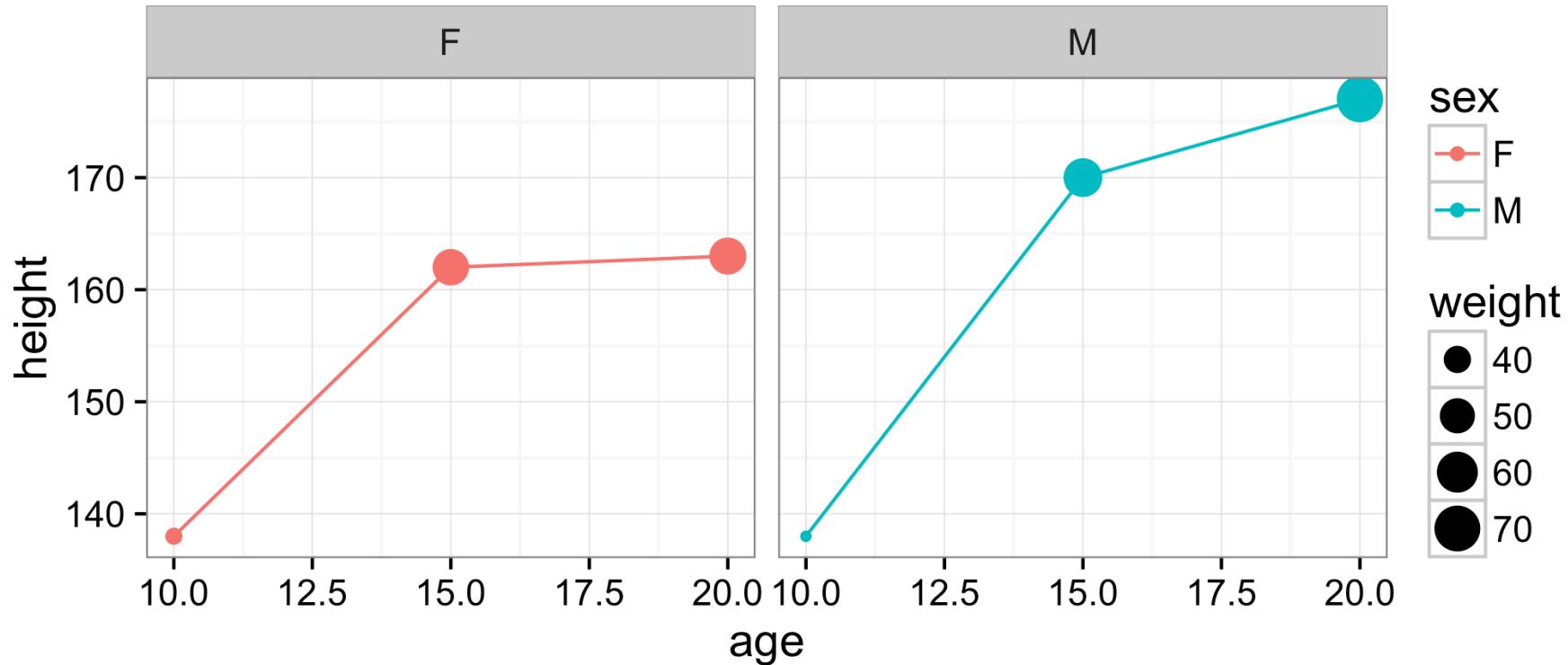
The weight-to-size mapping should only be applied to points

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



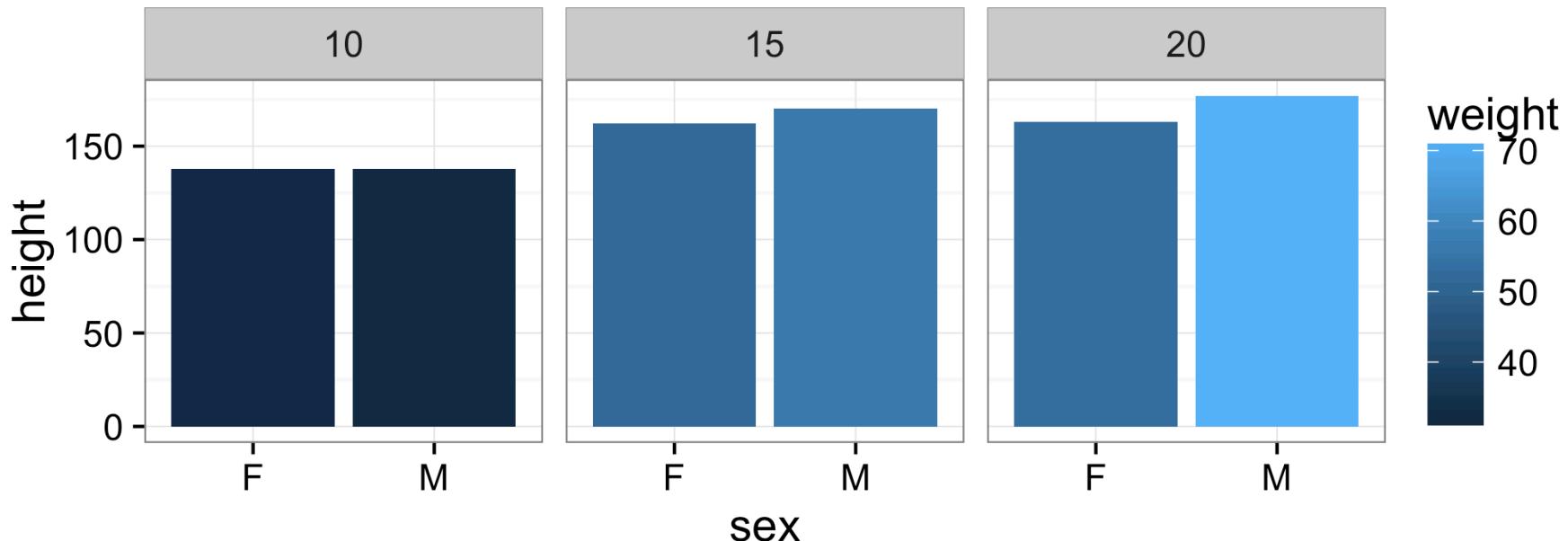
We can also make side-by-side plots (called facets)

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



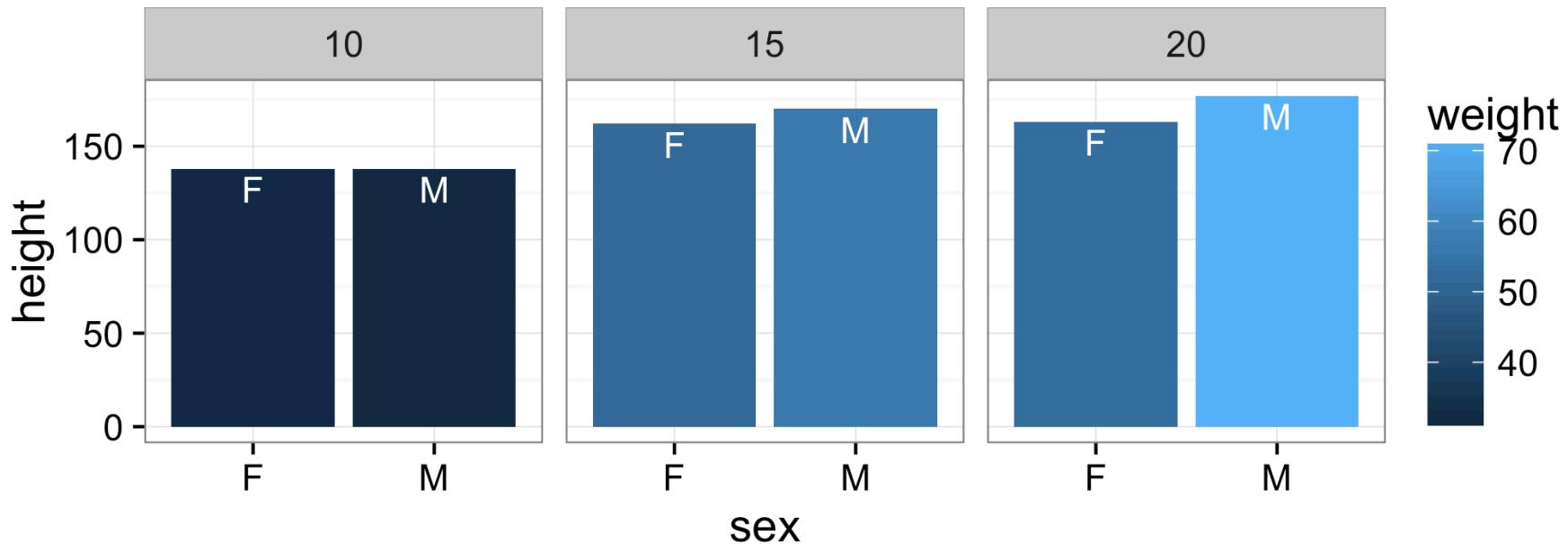
Now let's facet by age, color by weight, and use bars (columns) to plot height

```
ggplot(data, aes(x=sex, y=height, fill=weight)) +  
  geom_col() + 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_col() +  
  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://ggplot2.tidyverse.org/reference/>