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

angle

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

<table>
<thead>
<tr>
<th>age (yrs)</th>
<th>height (cm)</th>
<th>weight (kg)</th>
<th>sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>138</td>
<td>32</td>
<td>M</td>
</tr>
<tr>
<td>15</td>
<td>170</td>
<td>56</td>
<td>M</td>
</tr>
<tr>
<td>20</td>
<td>177</td>
<td>71</td>
<td>M</td>
</tr>
<tr>
<td>10</td>
<td>138</td>
<td>33</td>
<td>F</td>
</tr>
<tr>
<td>15</td>
<td>162</td>
<td>52</td>
<td>F</td>
</tr>
<tr>
<td>20</td>
<td>163</td>
<td>53</td>
<td>F</td>
</tr>
</tbody>
</table>

Data from: http://www.cdc.gov/growthcharts/
Map age to $x$, height to $y$, visualize using points

```r
ggplot(data, aes(x=age, y=height)) + geom_point()
```
Let’s color the points by sex

```r
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()
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)

```r
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

```r
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

```r
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/