Visualizing aspects of data with facets

COMMUNICATING WITH DATA IN THE TIDYVERSE

Timo Grossenbacher
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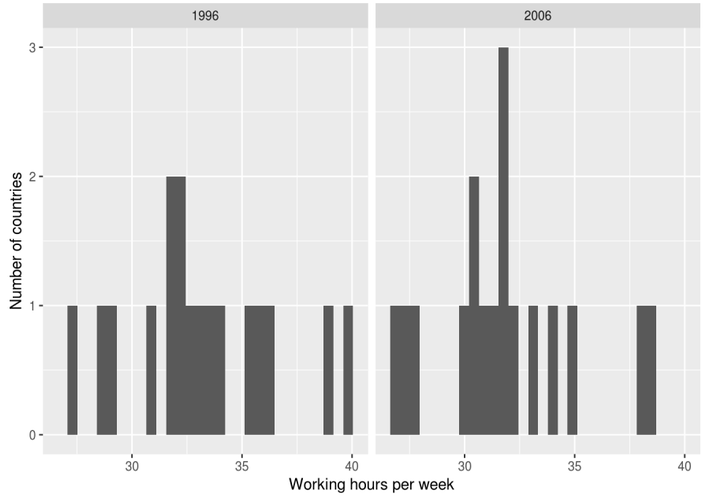
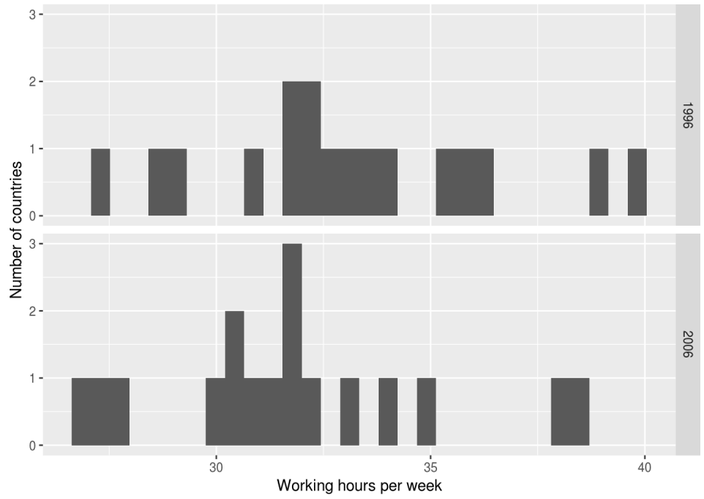
The facet_grid() function

```
ilo_data <- ilo_data %>%
  filter(year == "1996" | year == "2006")
ilo_plot <- ggplot(ilo_data) +
  geom_histogram(aes(
    x = working_hours)) +
  labs(x = "Working hours per week",
       y = "Number of countries")
```



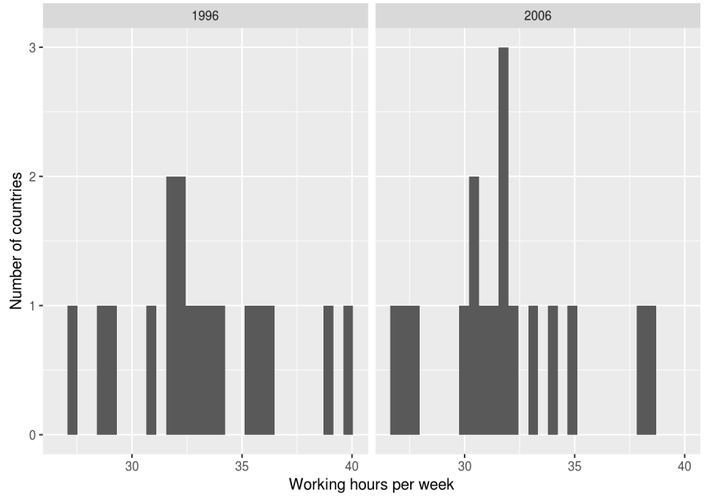

```
ilo_plot +
  facet_grid(. ~ year)
```

```
ilo_plot +
  facet_grid(year ~ .)
```

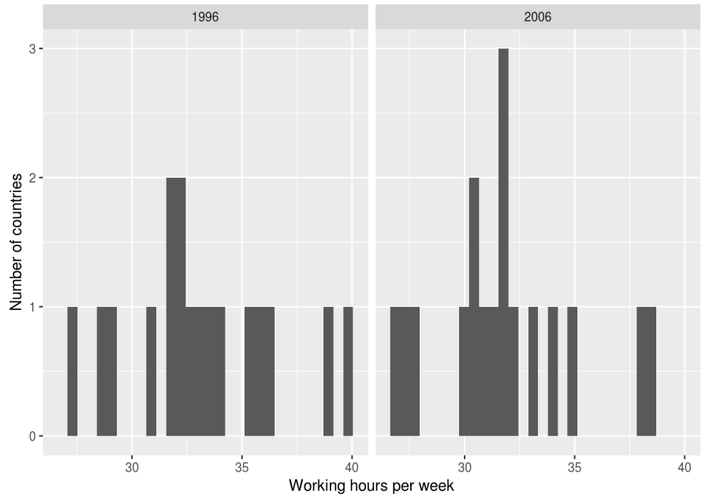


The facet_grid() function

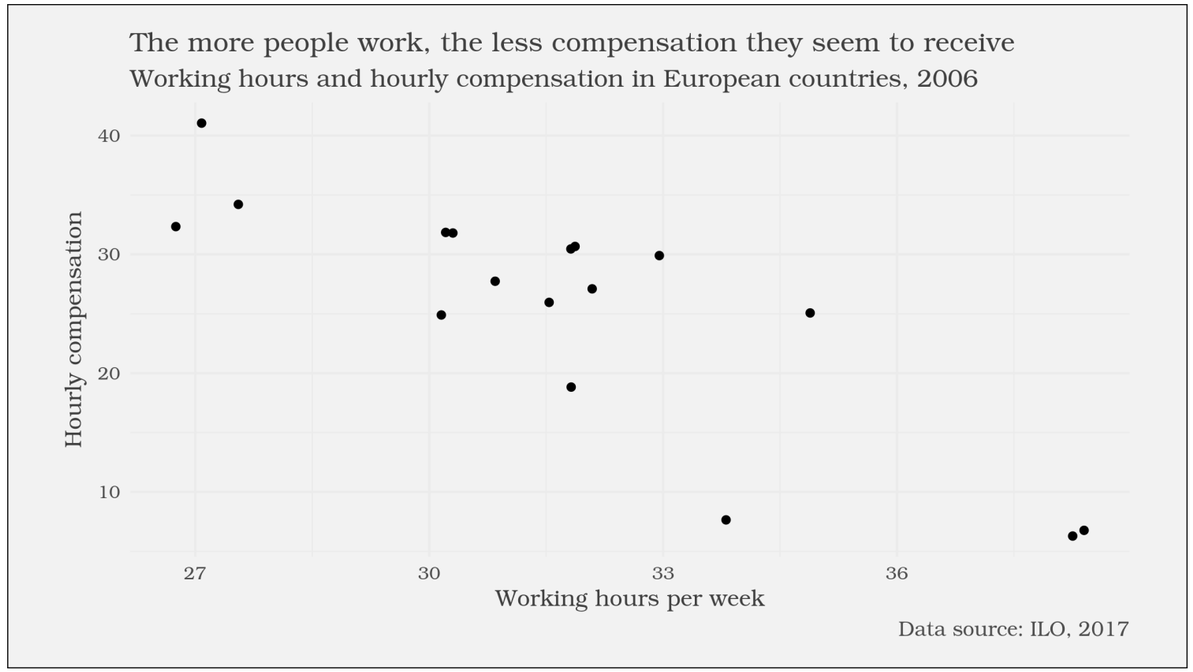
```
ilo_data <- ilo_data %>%
  filter(year == "1996" | year == "2006")
ggplot(ilo_data) +
  geom_histogram(aes(x = working_hours)) +
  labs(x = "Working hours per week",
       y = "Number of countries") +
  facet_grid(. ~ year)
```

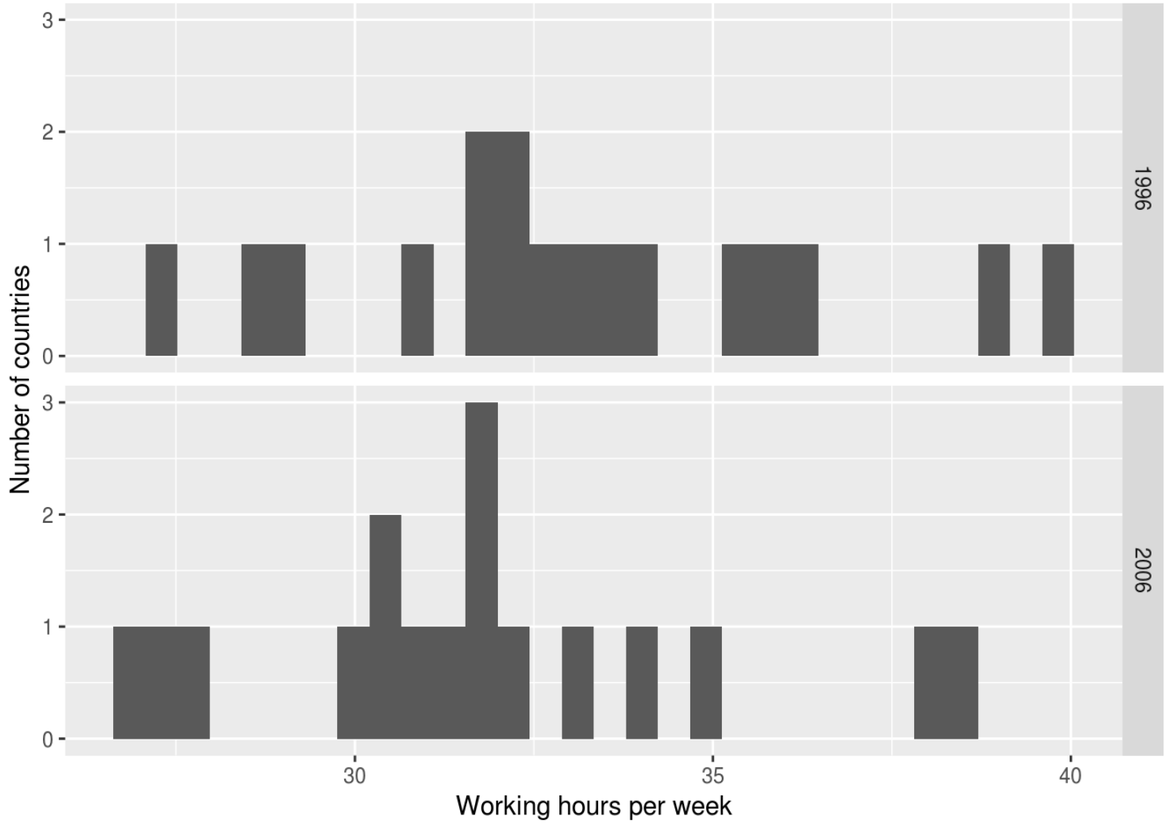



```
ggplot(ilo_data) +
  geom_histogram(aes(x = working_hours)) +
  labs(x = "Working hours per week",
       y = "Number of countries") +
  facet_wrap(facets = ~ year)
```



A faceted scatter plot





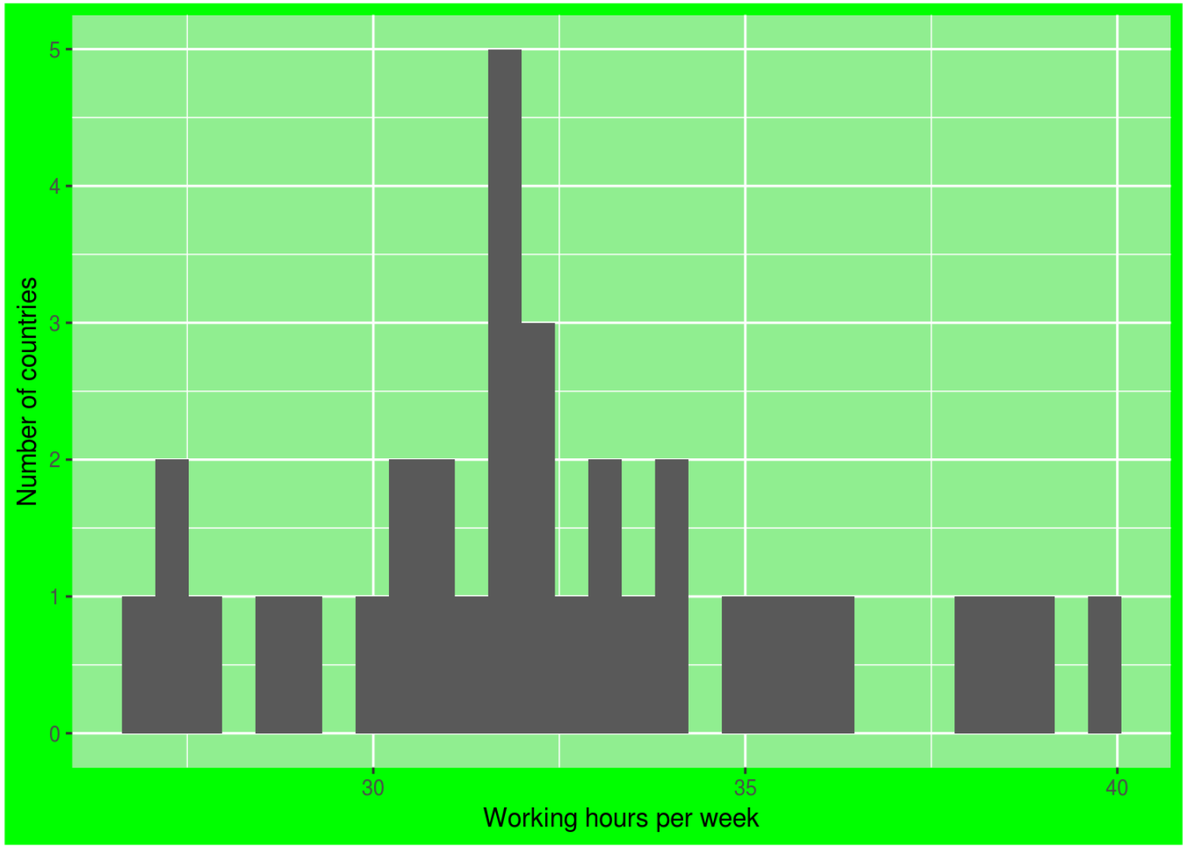
Styling faceted plots

```
strip.background
strip.text
...
```

Defining your own theme function

```
theme_green <- function(){
  theme(
    plot.background =
      element_rect(fill = "green"),
    panel.background =
      element_rect(fill =
        "lightgreen")
  )}
```

```
ggplot(ilo_data) +
  geom_histogram(aes(
    x = working_hours)) +
  labs(x = "Working hours per week",
       y = "Number of countries") +
theme_green()
```



Let's practice!

COMMUNICATING WITH DATA IN THE TIDYVERSE

A custom plot to emphasize change

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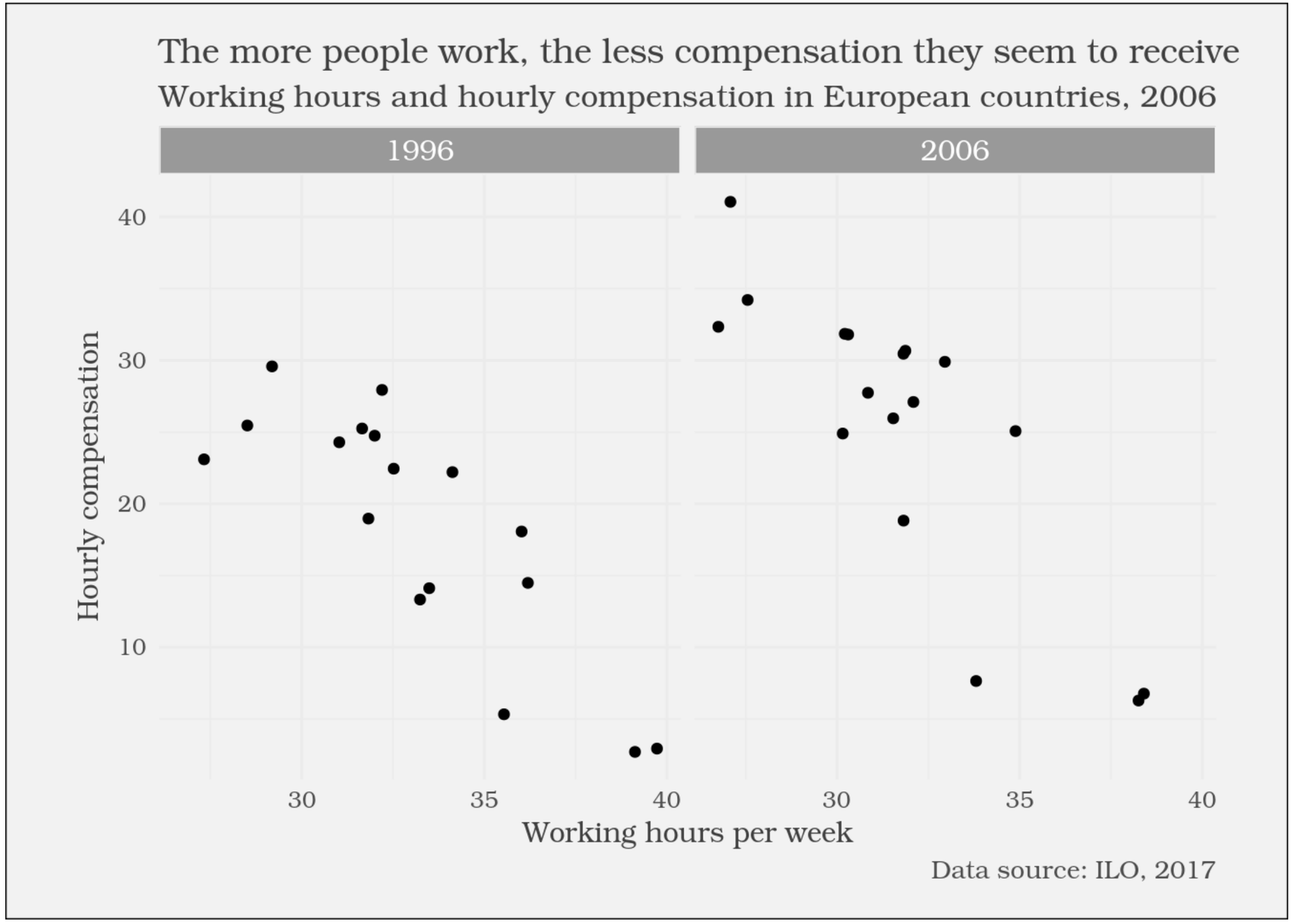
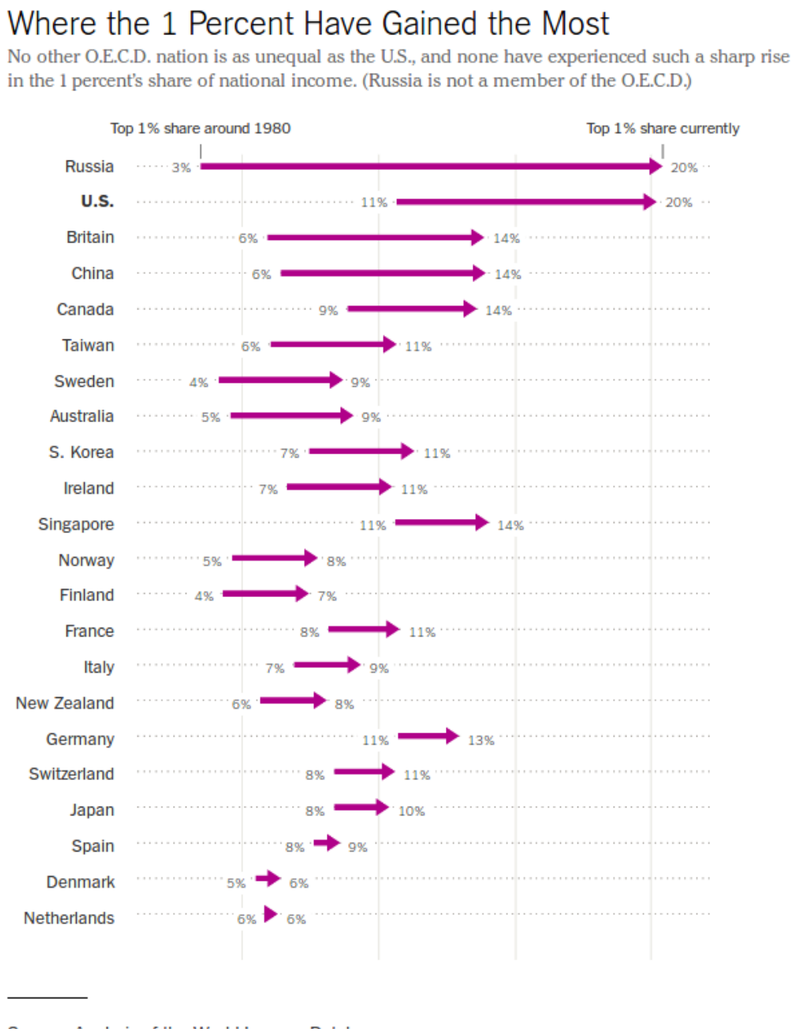
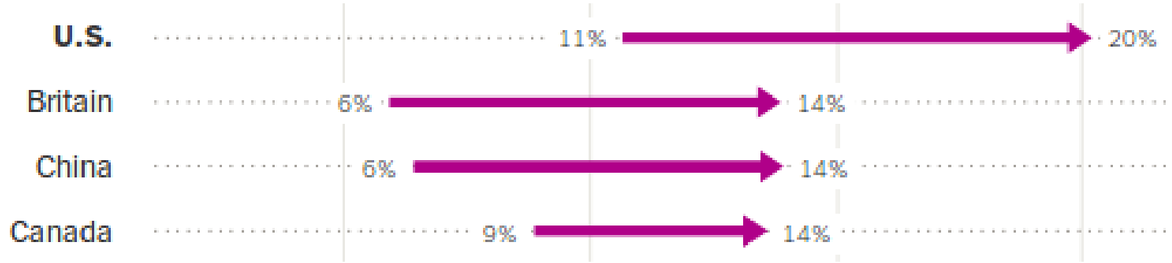

The more people work, the less compensation they seem to receive
Working hours and hourly compensation in European countries, 2006
1996
2006
Hourly compensation
40
30
20
10
30
35
40
Working hours per week
Data source: ILO, 2017

The dot plot

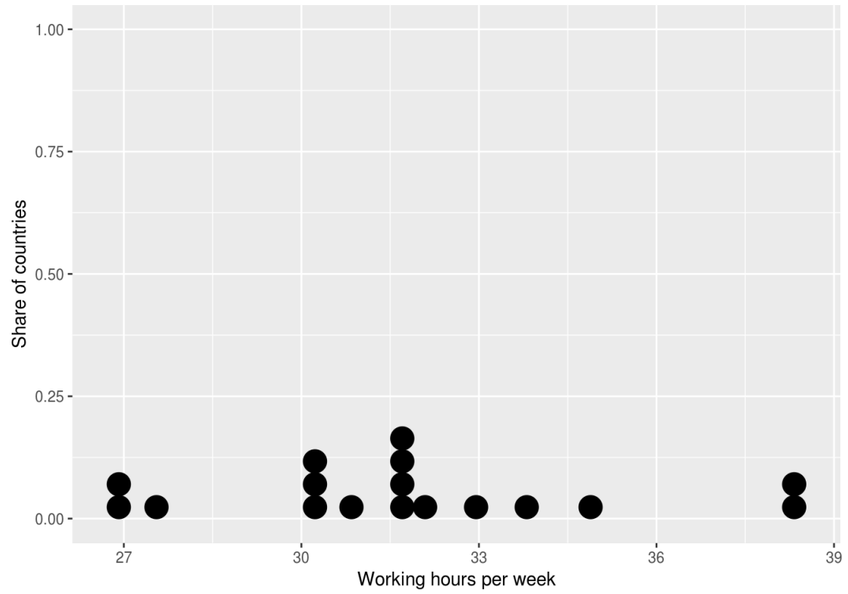




[1] New York Times (https://www.nytimes.com/2017/11/17/upshot/income-inequality-united-states.html){{0}}

Dot plots with ggplot2

```
ggplot((ilo_data %>% filter(year == 2006))) +
  geom_dotplot(aes(x = working_hours)) +
  labs(x = "Working hours per week",
       y = "Share of countries")
```



The geom_path() function

```
?geom_path
```

`geom_path()` *connects the observations in the order in which they appear in the data.*

```
ilo_data %>%
    arrange(country)
```

```
# A tibble: 34 x 4
     country   year hourly_compensation working_hours
      <fctr> <fctr>                <dbl>         <dbl>
1    Austria   1996                24.75      31.99808
2    Austria   2006                30.46      31.81731
3    Belgium   1996                25.25      31.65385
4    Belgium   2006                31.85      30.21154
5 Czech Rep.   1996                 2.94      39.72692
# ... with 29 more rows
```

Dot plots with `ggplot2`: the `geom_path()` function

```
ggplot() +
    geom_path(aes(x = numeric_variable, y = numeric_variable))
```

```
ggplot() +
    geom_path(aes(x = numeric_variable, y = factor_variable))
```

```
ggplot() +
    geom_path(aes(x = numeric_variable, y = factor_variable),
                  arrow = arrow(___))
```

Let's try out geom_path!

COMMUNICATING WITH DATA IN THE TIDYVERSE

Polishing the dot plot

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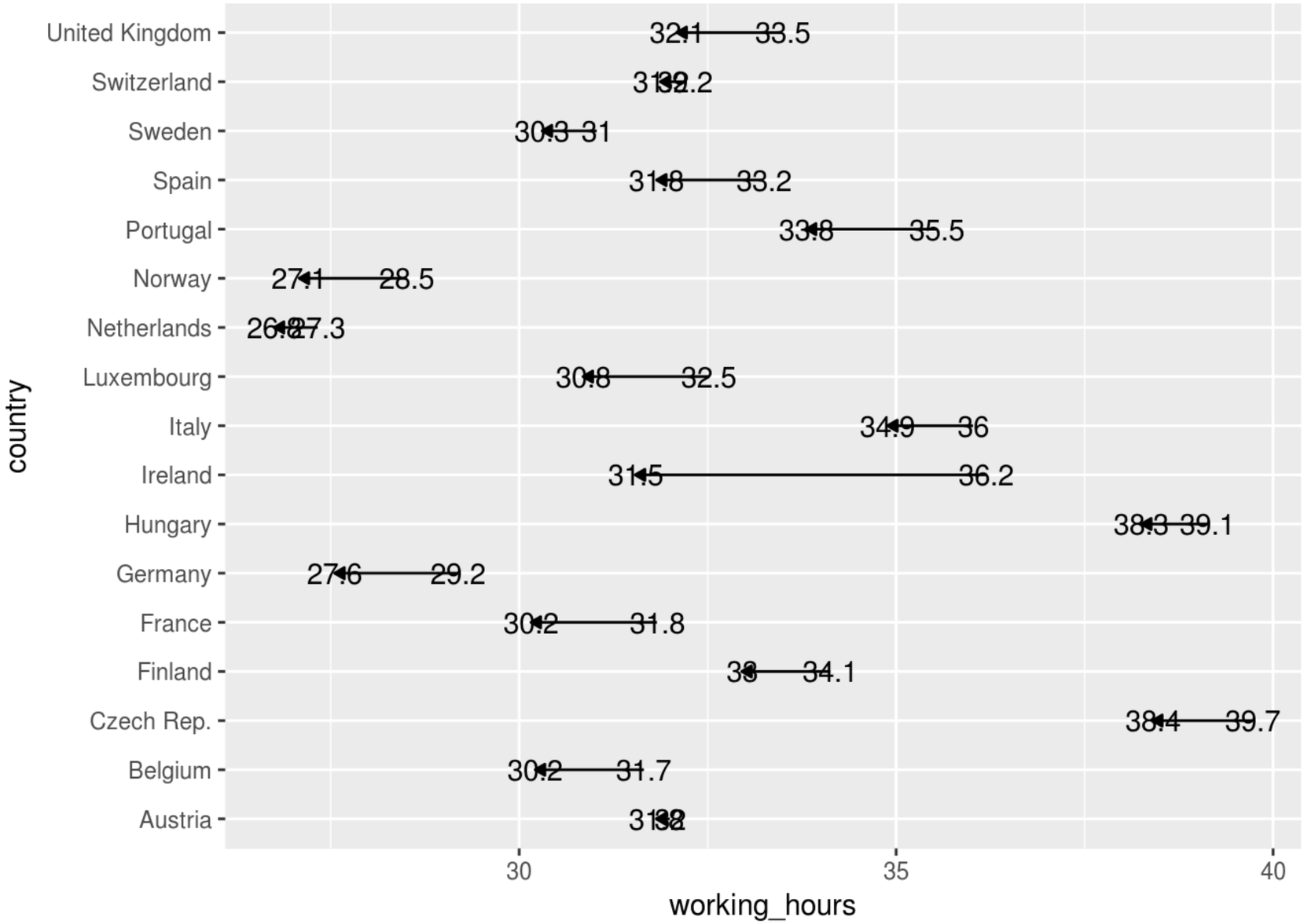
United Kingdom
Switzerland
Sweden
Spain
Portugal
Norway
Netherlands
Luxembourg
Italy
Ireland
Hungary
Germany
France
Finland
Czech Rep.
Belgium
Austria
country
30
35
40
working_hours

Factor levels

- The order of factor **levels** determine the order of appearance in `ggplot2` .

```
ilo_data$country
```

```
Austria        Belgium        Czech Rep.     Finland
France         Germany        Hungary    ...
 ...
 17 Levels: Austria Belgium Czech Rep. Finland France ... United Kingdom
```

Reordering factors with the forcats package

- Needs to be loaded with `library(forcats)`
- `fct_drop` for dropping levels
- `fct_rev` for reversing factor levels
- `fct_reorder` for reordering them.

[1] Learn more at tidyverse.org (http://forcats.tidyverse.org/)

The fct_reorder function

```
ilo_data
```

```
# A tibble: 34 x 4
      country   year hourly_compensation working_hours
       <fctr> <fctr>                <dbl>         <dbl>
 1    Austria   1996                24.75      31.99808
 2    Austria   2006                30.46      31.81731
 3    Belgium   1996                25.25      31.65385
 4    Belgium   2006                31.85      30.21154
```

```
ilo_data <- ilo_data  %>%
    mutate(country = fct_reorder(country, working_hours, mean))
ilo_data$country
```

```
17 Levels: Netherlands Norway Germany Sweden ... Czech Rep.
```

```
ilo_data <- ilo_data  %>%
    mutate(country = fct_reorder(country, working_hours, mean))
```

```
# A tibble: 34 x 4
      country   year hourly_compensation working_hours
       <fctr> <fctr>                <dbl>         <dbl>
 1     Austria   1996                24.75      31.99808
 2     Austria   2006                30.46      31.81731
 3     Belgium   1996                25.25      31.65385
 4     Belgium   2006                31.85      30.21154
 5 Czech Rep.   1996                 2.94      39.72692
 6 Czech Rep.   2006                 6.77      38.40000
```

mean(c(31.99808, 31.81731))

mean(c(31.65385, 30.21154))

mean(c(39.72692, 38.40000))

Nudging labels with hjust and vjust

```
ggplot(ilo_data) +
  geom_path(aes(...)) +
  geom_text(
        aes(...,
            hjust = ifelse(year == "2006",
              1.4,
              -0.4)
        )
    )
```

Let's practice!

COMMUNICATING WITH DATA IN THE TIDYVERSE

Finalizing the plot for different audiences and devices

COMMUNICATING WITH DATA IN THE TIDYVERSE

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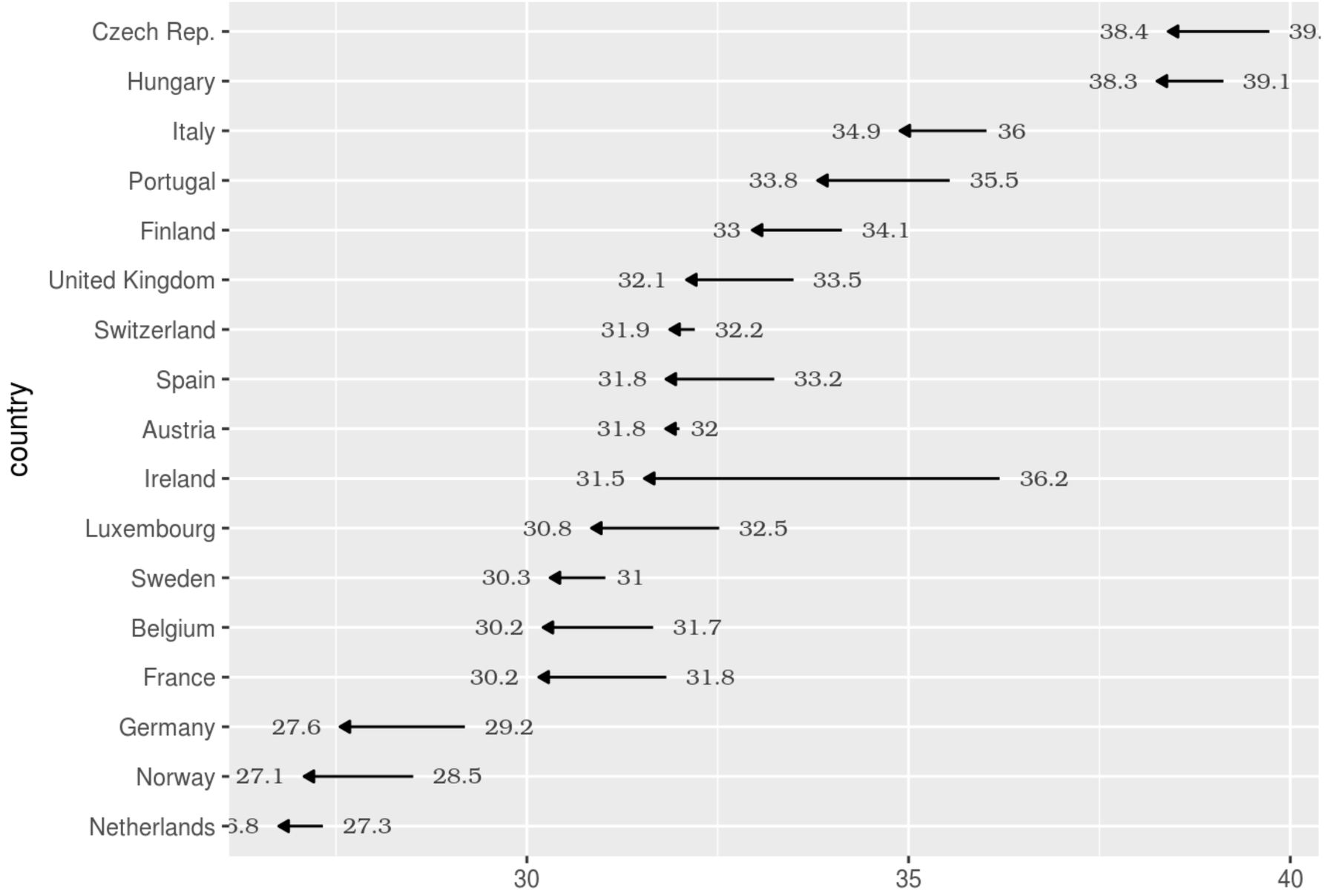
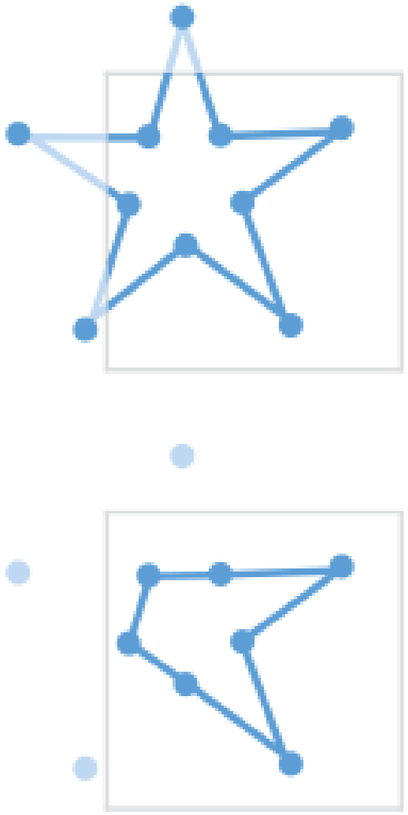

country
Czech Rep.
Hungary
Italy
Portugal
Finland
United Kingdom
Switzerland
Spain
Austria
Ireland
Luxembourg
Sweden
Belgium
France
Germany
Norway
Netherlands
38.4
39.
38.3
39.1
34.9
36
33.8
35.5
33
34.1
32.1
33.5
31.9
32.2
31.8
33.2
31.8
32
31.5
36.2
30.8
32.5
30.3
31
30.2
31.7
30.2
31.8
27.6
29.2
27.1
28.5
27.3
30
35
40

coord_cartesian vs. xlim / ylim

```
ggplot_object +
    coord_cartesian(xlim = c(0, 100), ylim = c(10, 20))
```

```
ggplot_object +
    xlim(0, 100) +
    ylim(10, 20)
```

coord_cartesian vs. xlim / ylim



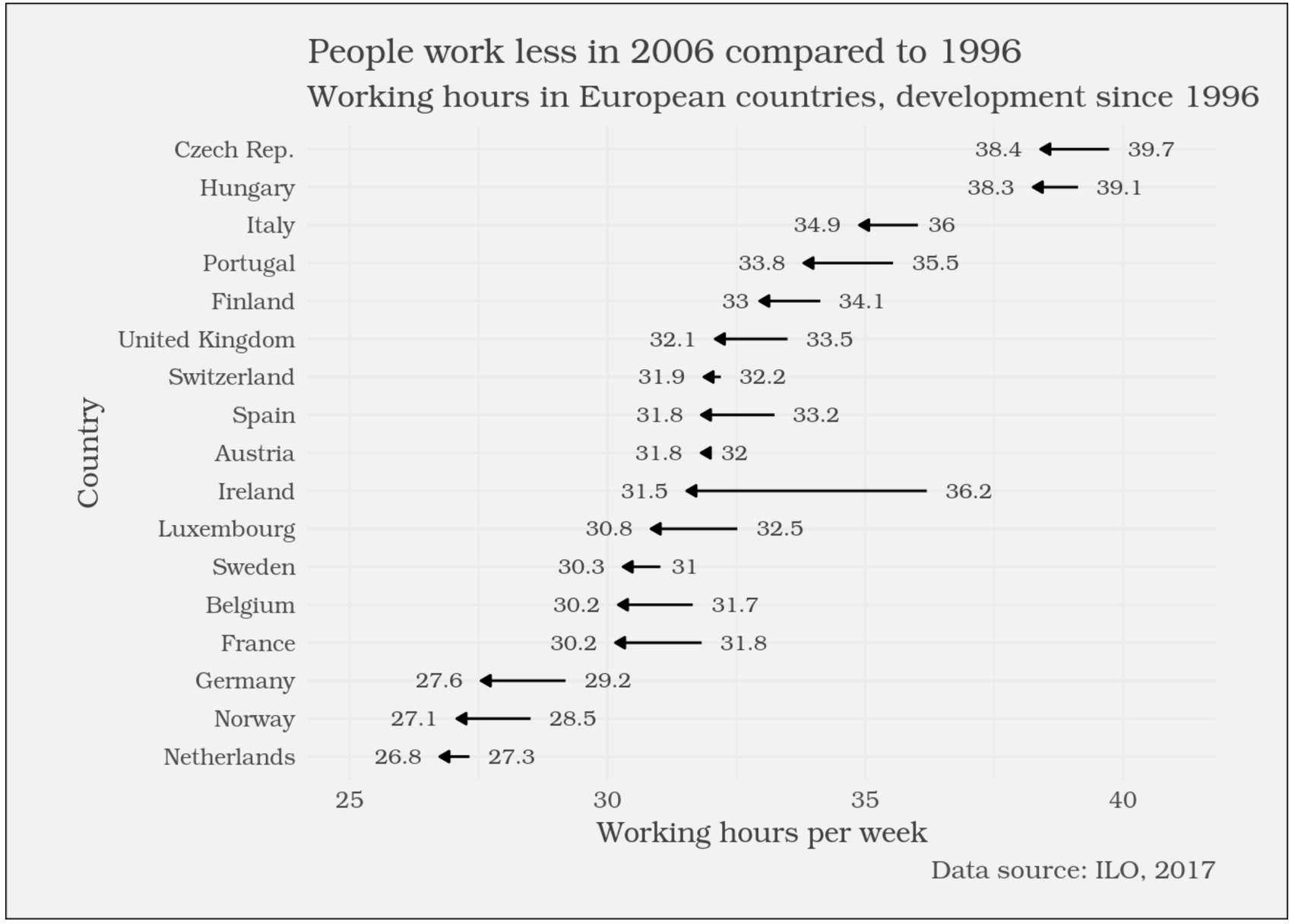
Without clipping (preferred)

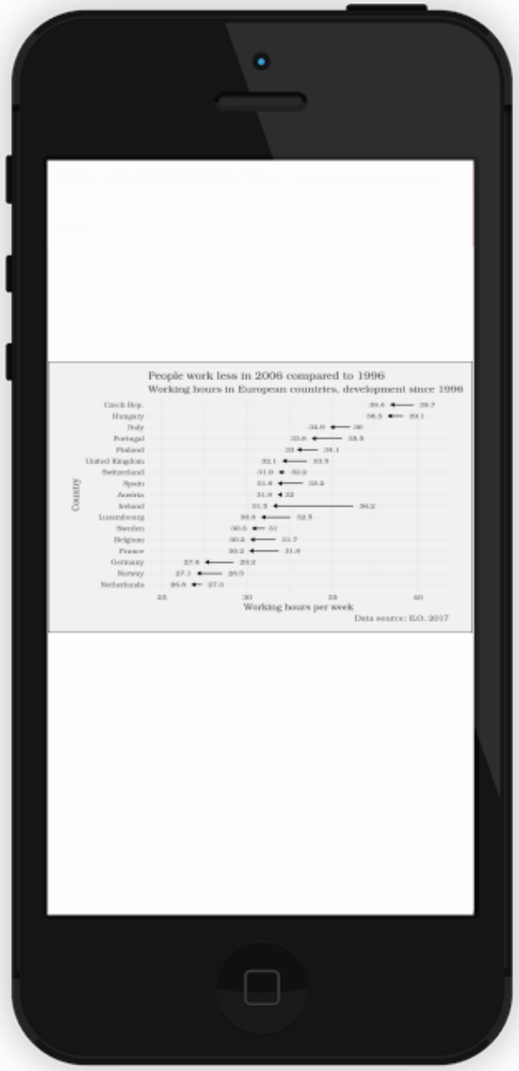
```
t + coord_cartesian(
xlim = c(0, 100), ylim = c(10, 20))
```

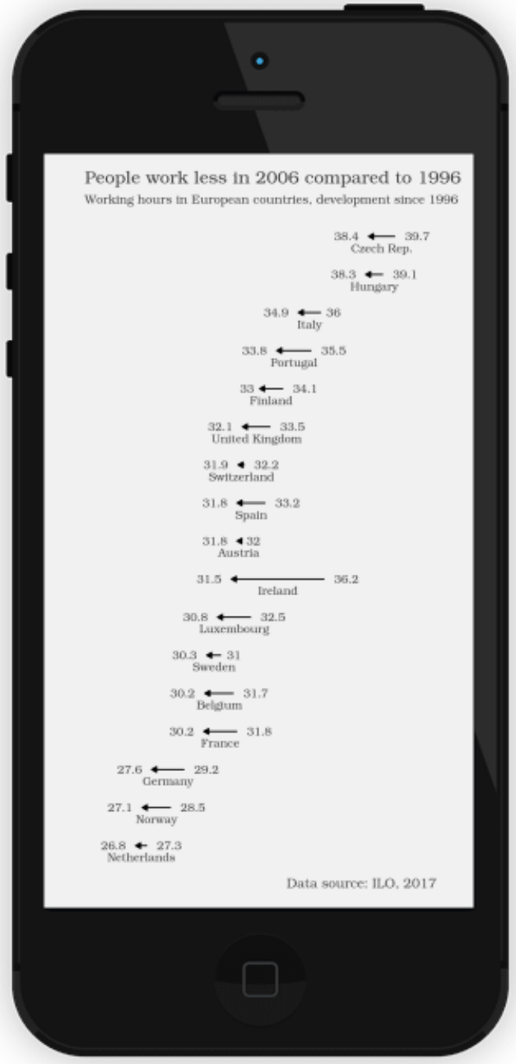
With clipping (removes unseen data points)

```
t + xlim(0, 100) + ylim(10, 20)
```

[1] Taken from RStudio Data Visualization Cheat Sheet (https://github.com/rstudio/cheatsheets/raw/master/data-visualization-2.1.pdf)


People work less in 2006 compared to 1996
Working hours in European countries, development since 1996
Country
Czech Rep. 38.4 39.7
Hungary 38.3 39.1
Italy 34.9 36
Portugal 33.8 35.5
Finland 33 34.1
United Kingdom 32.1 33.5
Switzerland 31.9 32.2
Spain 31.8 33.2
Austria 31.8 32
Ireland 31.5 36.2
Luxembourg 30.8 32.5
Sweden 30.3 31
Belgium 30.2 31.7
France 30.2 31.8
Germany 27.6 29.2
Norway 27.1 28.5
Netherlands 26.8 27.3
25
30
35
40
Working hours per week
Data source: ILO, 2017


People work less in 2006 compared to 1996
Working hours in European countries, development since 1996
Czech Rep. 38.4 ← 39.7
Hungary 38.3 ← 39.1
Italy 34.9 ← 36
Portugal 33.8 ← 35.5
Finland 33 ← 34.1
United Kingdom 32.1 ← 33.5
Switzerland 31.9 ◂ 32.2
Spain 31.8 ← 33.2
Austria 31.8 ◂ 32
Ireland 31.5 ← 36.2
Luxembourg 30.8 ← 32.5
Sweden 30.3 ← 31
Belgium 30.2 ← 31.7
France 30.2 ← 31.8
Germany 27.6 ← 29.2
Norway 27.1 ← 28.5
Netherlands 26.8 ← 27.3
Country
20
30
40
Working hours per week
Data source: ILO, 2017


People work less in 2006 compared to 1996
Working hours in European countries, development since 1996
38.4 ← 39.7
Czech Rep.
38.3 ← 39.1
Hungary
34.9 ← 36
Italy
33.8 ← 35.5
Portugal
33 ← 34.1
Finland
32.1 ← 33.5
United Kingdom
31.9 ◂ 32.2
Switzerland
31.8 ← 33.2
Spain
31.8 ◂ 32
Austria
31.5 ← 36.2
Ireland
30.8 ← 32.5
Luxembourg
30.3 ← 31
Sweden
30.2 ← 31.7
Belgium
30.2 ← 31.8
France
27.6 ← 29.2
Germany
27.1 ← 28.5
Norway
26.8 ← 27.3
Netherlands
Data source: ILO, 2017

Let's produce these plots!

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