EPSY 887: Computation Statistics

Plotting

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Week 4
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Agenda

1. ggplot2: A Grammar of Graphics
2. likert Package

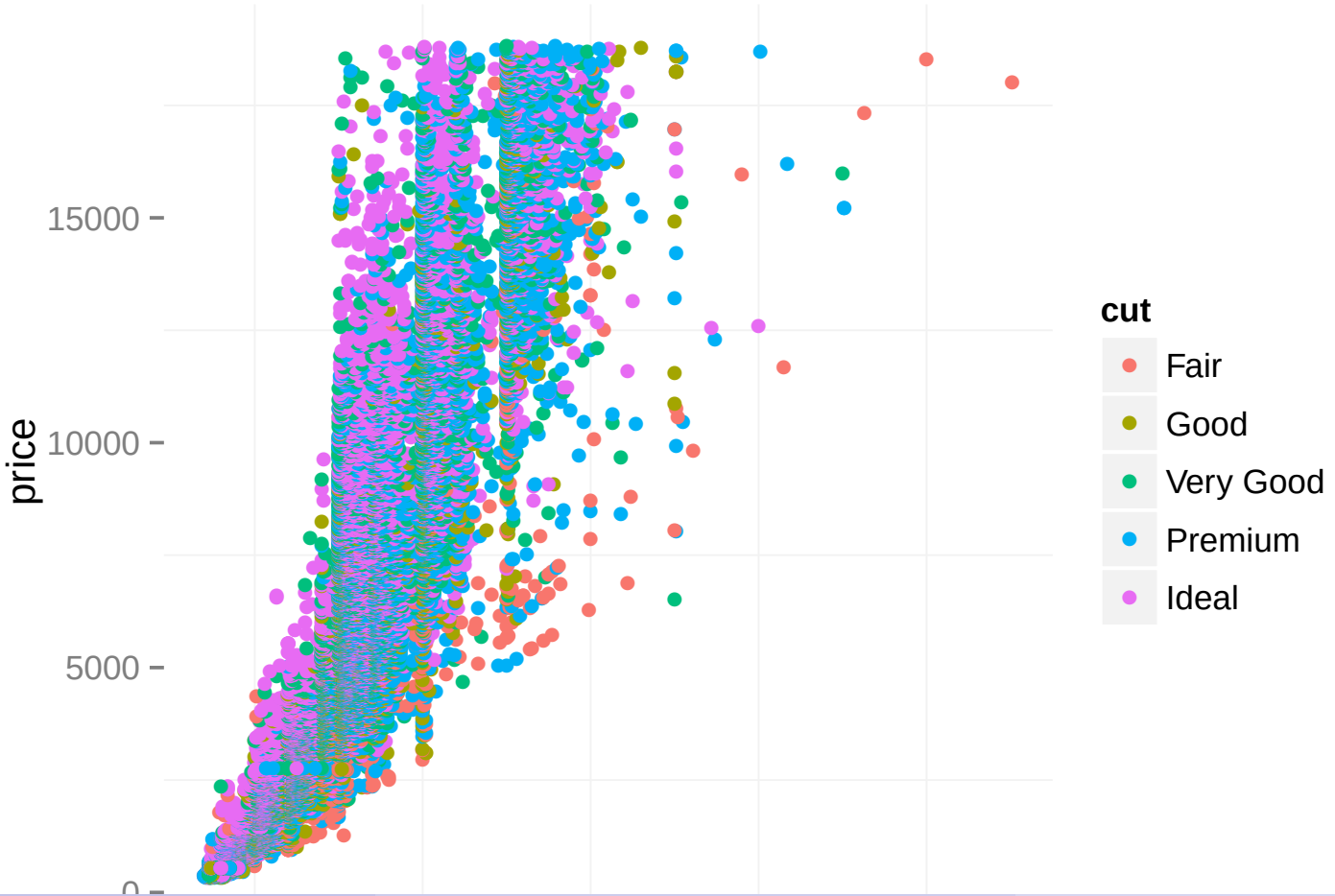
ggplot2: A Grammar of Graphics

- ggplot2 is an R package that provides an alternative framework based upon Wilkinson's (2005) Grammar of Graphics.
- ggplot2 is, in general, more flexible for creating "prettier" and complex plots.
- Works by creating layers of different types of objects/geometries (i.e. bars, points, lines, polygons, etc.)
- ggplot2 has at least three ways of creating plots:
  1. `qplot`
  2. `ggplot(...) + geom_XXX(...) + ...`
  3. `ggplot(...) + layer(...)`

  We will focus only on the second.

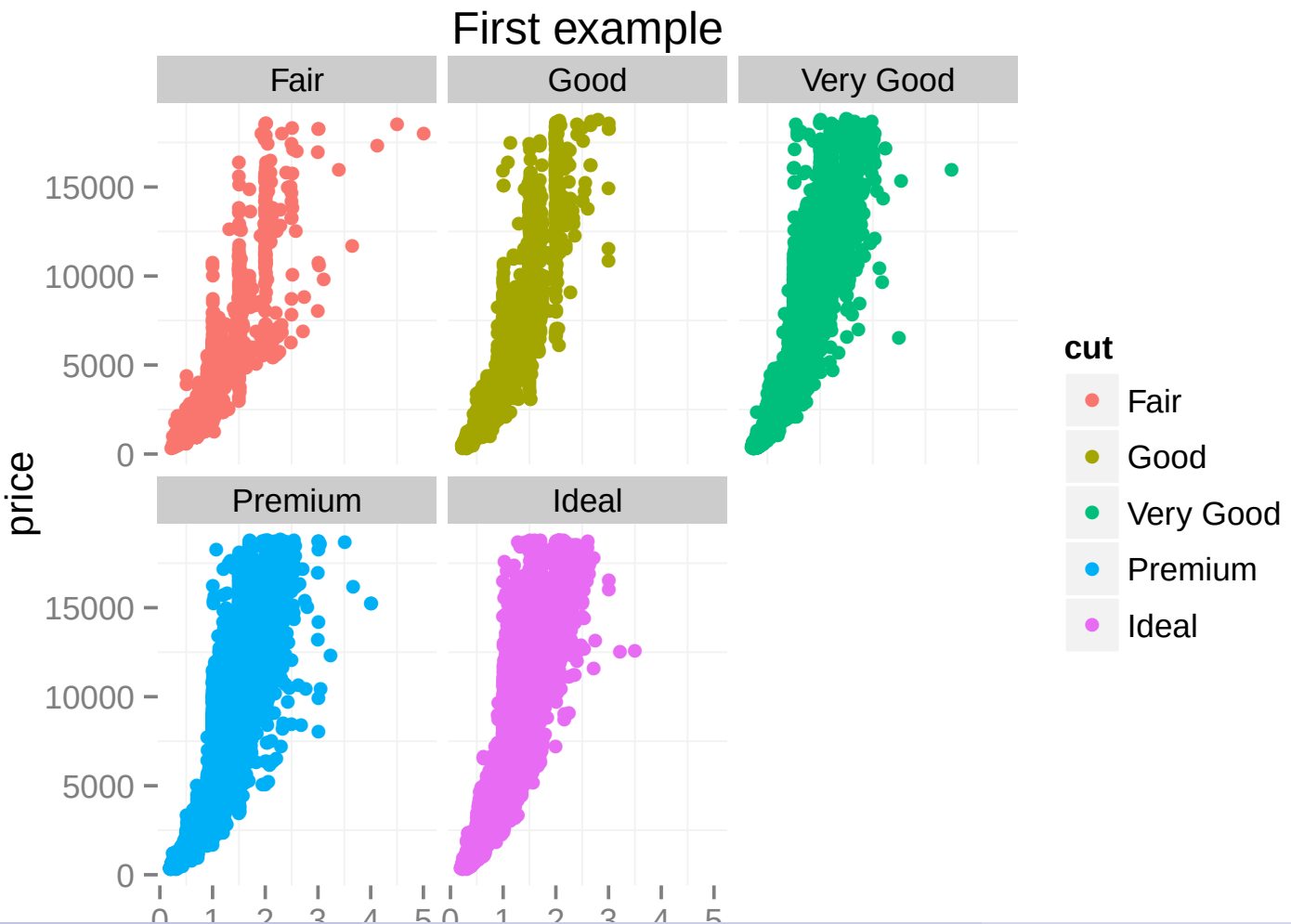
First Example

```
> data(diamonds)
> p <- ggplot(diamonds, aes(x=carat,y=price,colour=cut)) +
    geom_point()
> print(p)
```



First Example

```
> p <- p + facet_wrap(~cut) +
    ggtitle("First example")
> print(p)
```



Parts of a ggplot2 statement

- Data

```
ggplot(myDataFrame, aes(x=x, y=y)
```

Parts of a ggplot2 statement

- Data

  ```
  ggplot(myDataFrame, aes(x=x, y=y)
  ```

- Layers

  ```
  geom_point(), geom_histogram()
  ```

Parts of a ggplot2 statement

- Data

  `ggplot(myDataFrame, aes(x=x, y=y)`

- Layers

  `geom_point(), geom_histogram()`

- Facets

  `facet_wrap(~ cut), facet_grid(~ cut)`

Parts of a ggplot2 statement

- Data

  `ggplot(myDataFrame, aes(x=x, y=y)`

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  `geom_point(), geom_histogram()`

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  `facet_wrap(~ cut), facet_grid(~ cut)`

- Scales

  `scale_y_log10()`

Parts of a ggplot2 statement

- Data

  `ggplot(myDataFrame, aes(x=x, y=y)`

- Layers

  `geom_point(), geom_histogram()`

- Facets

  `facet_wrap(~ cut), facet_grid(~ cut)`

- Scales

  `scale_y_log10()`

- Other options

  `ggtitle("my title"), ylim(c(0, 10000)), xlab("x-axis label")`

Lots of geoms

```
geom_abline
geom_jitter
geom_area
geom_line
geom_bar
geom_linerange
geom_bin2d
geom_path
geom_blank
geom_point
geom_boxplot
geom_pointrange
geom_contour
geom_polygon
geom_crossbar
geom_quantile
```

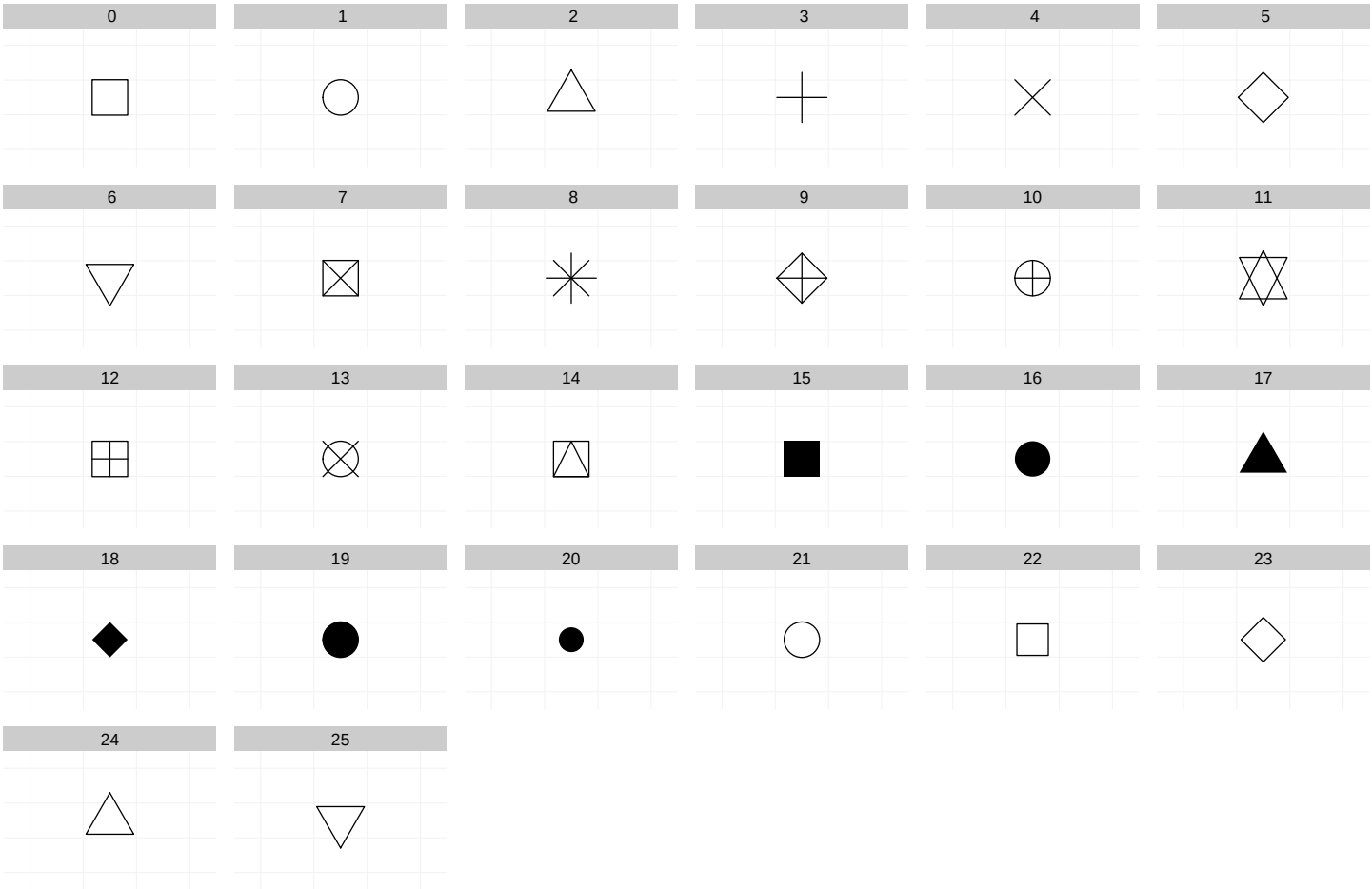
```
geom_density
geom_rect
geom_density2d
geom_ribbon
geom_errorbar
geom_rug
geom_errorbarh
geom_segment
geom_freqpoly
geom_smooth
geom_hex
geom_step
geom_histogram
geom_text
geom_hline
geom_tile
geom_vline
```

Symbols

```
> p.symbols <- ggplot(data=data.frame(x=c(0:25))) +
      geom_point(size=10, aes(x=x,y=x,shape=x)) +
    facet_wrap(~ x, scales="free") +
    xlab("") + ylab("") +
    scale_shape_identity() +
    theme(axis.text.x=element_blank(),
          axis.text.y=element_blank(),
          axis.ticks=element_blank(),
          legend.position="none")
```

Symbols

```
> print(p.symbols)
```

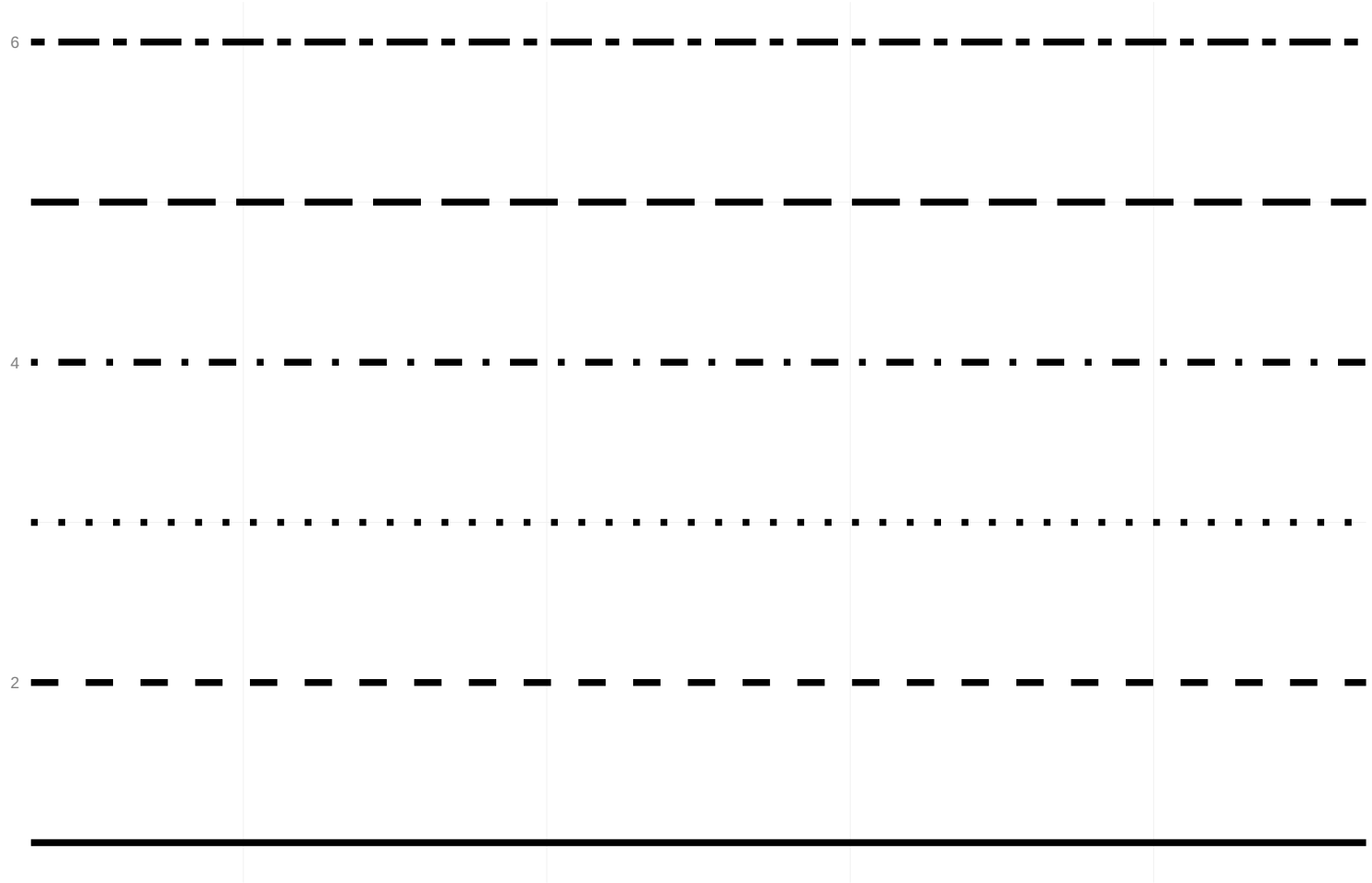


Line Types

```
> p.linetypes <- ggplot(data=data.frame(x=c(1:6))) +
      geom_hline(size=2, aes(yintercept=x, linetype=x)) +
    scale_linetype_identity() +
    xlab(NULL) + ylab(NULL) + xlim(c(0,100)) +
    theme(axis.text.x=element_blank(), axis.ticks=element_blank(), l
```

Line Types

```
> print(p.linetypes)
```



Colors

```
> getColorHexAndDecimal <- function(color) {
    if(is.na(color)) {
    return(NA)
    } else {
    c <- col2rgb(color)
    return(sprintf("#%02X%02X%02X   %3d %3d %3d",
        c[1],c[2],c[3], c[1], c[2], c[3]))
    }
   }
```

Colors

```
> df = data.frame(x=rep(1:26, 26), y=rep(1:26, each=26))
> df$c = NA
> df[1:length(colors()),"c"] = colors()
> df$n = NA
> df[1:length(colors()),"n"] = 1:length(colors())
> df$r = df$g = df$b = NA
> df[1:length(colors()),c("r","g","b")] = t(col2rgb(colors()))
> df$text = ifelse(apply(df[,c("r","g","b")], 1, sum) >
      (255*3/2), "black", "white")
> df$hex = lapply(df$c, getColorHexAndDecimal)
> df$hex2 = paste(format(df$n, width=3),
      format(df$c, width=(max(nchar(df$c))+1)),
      format(df$hex, width=(max(nchar(df$hex))+1)))
```

Colors

```
> p.colors <- ggplot(df, aes(x=x, y=y, fill=c, label=n)) +
      geom_tile() +
    geom_text(aes(colour=text), size=3) +
    scale_fill_identity() +
    scale_colour_identity() +
    xlab(NULL) + ylab(NULL) +
    theme(axis.text.x=element_blank(),
          axis.ticks=element_blank(),
      plot.margin=unit(c(0,0,0,0), "cm"),
      axis.text.y=element_blank(),
      axis.ticks=element_blank(),
      legend.position="none")
```

Colors

```
> print(p.colors)
```

Agenda

1. ggplot2: A Grammar of Graphics

2. likert Package

likert Package

The `likert` package provides functions to analyze and visualize Likert items. The graphics are created using `ggplot2`.

```
> require(devtools)
> install_github("likert","jbryer")
```

The package includes a subset of the PISA data. Item 28 of the student questionnaire contains 11 items about student reading habits.

```
> require(likert)
> data(pisaitems)
> items28 = pisaitems[,substr(names(pisaitems), 1,5) == "ST24Q"]
```

Data Setup

First, rename the columns to the item stems.

```
> items28 <- rename(items28, c(
    ST24Q01="I read only if I have to.",
    ST24Q02="Reading is one of my favorite hobbies.",
    ST24Q03="I like talking about books with other people.",
    ST24Q04="I find it hard to finish books.",
    ST24Q05="I feel happy if I receive a book as a present.",
    ST24Q06="For me, reading is a waste of time.",
    ST24Q07="I enjoy going to a bookstore or a library.",
    ST24Q08="I read only to get information that I need.",
    ST24Q09="I cannot sit still and read for more than a few minutes
    ST24Q10="I like to express my opinions about books I have read."
    ST24Q11="I like to exchange books with my friends"))
```

Analyzing Likert Items

The `likert` function will analyze the items.

```
> l28 = likert(items28)
```

And the `print` method will provide percentages of each category.

```
> print(l28)
```

```
                                                    Item
1                                I read only if I have to.
2                    Reading is one of my favorite hobbies.
3             I like talking about books with other people.
4                           I find it hard to finish books.
5            I feel happy if I receive a book as a present.
6                      For me, reading is a waste of time.
7               I enjoy going to a bookstore or a library.
8              I read only to get information that I need.
9  I cannot sit still and read for more than a few minutes.
10   I like to express my opinions about books I have read.
11                I like to exchange books with my friends
   Strongly disagree Disagree Agree Strongly agree
1                 23       36    31           10.7
2                 20       36    32           11.4
3                 21       34    36            9.0
4                 25       40    27            8.1
5                 19       28    40           12.9
6                 42       41    11            6.1
7                 18       33    37           11.9
8                 15       35    36           13.8
9                 33       43    17            6.8
10                14       28    44           15.1
11                23       33    32           12.4
```

Likert SUmmary

The summary method will provide provide descriptive statistics.

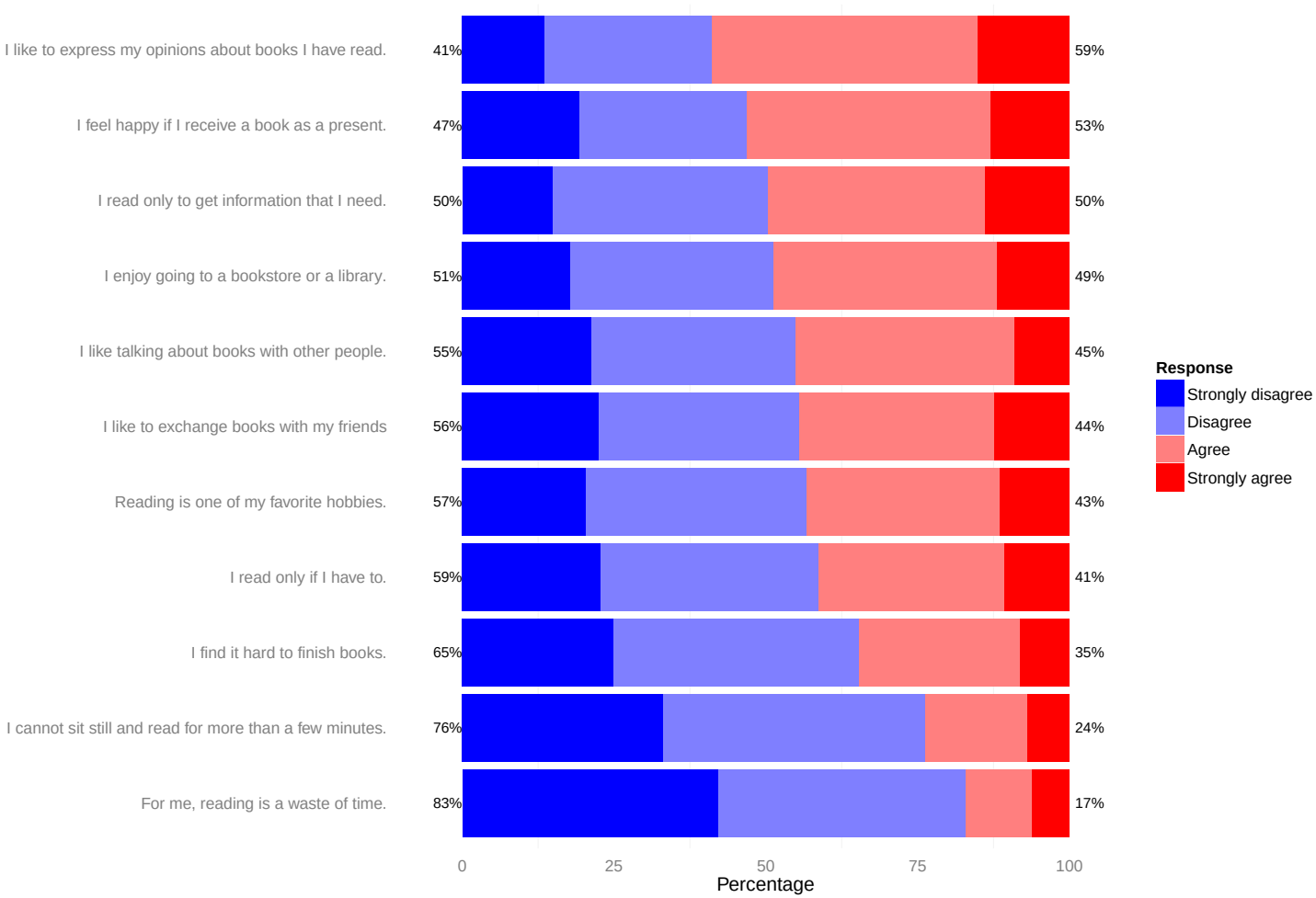
```
> summary(128)
```

	Item	low	high	mean	sd
1	I read only if I have to.	59	41	2.3	0.94
2	Reading is one of my favorite hobbies.	57	43	2.3	0.93
3	I like talking about books with other people.	55	45	2.3	0.91
4	I find it hard to finish books.	65	35	2.2	0.90
5	I feel happy if I receive a book as a present.	47	53	2.5	0.94
6	For me, reading is a waste of time.	83	17	1.8	0.86
7	I enjoy going to a bookstore or a library.	51	49	2.4	0.92
8	I read only to get information that I need.	50	50	2.5	0.91
9	I cannot sit still and read for more than a few minutes.	76	24	2.0	0.88
10	I like to express my opinions about books I have read.	41	59	2.6	0.90
11	I like to exchange books with my friends	56	44	2.3	0.96

Bar Plot

The `summary` method will provide provide descriptive statistics.

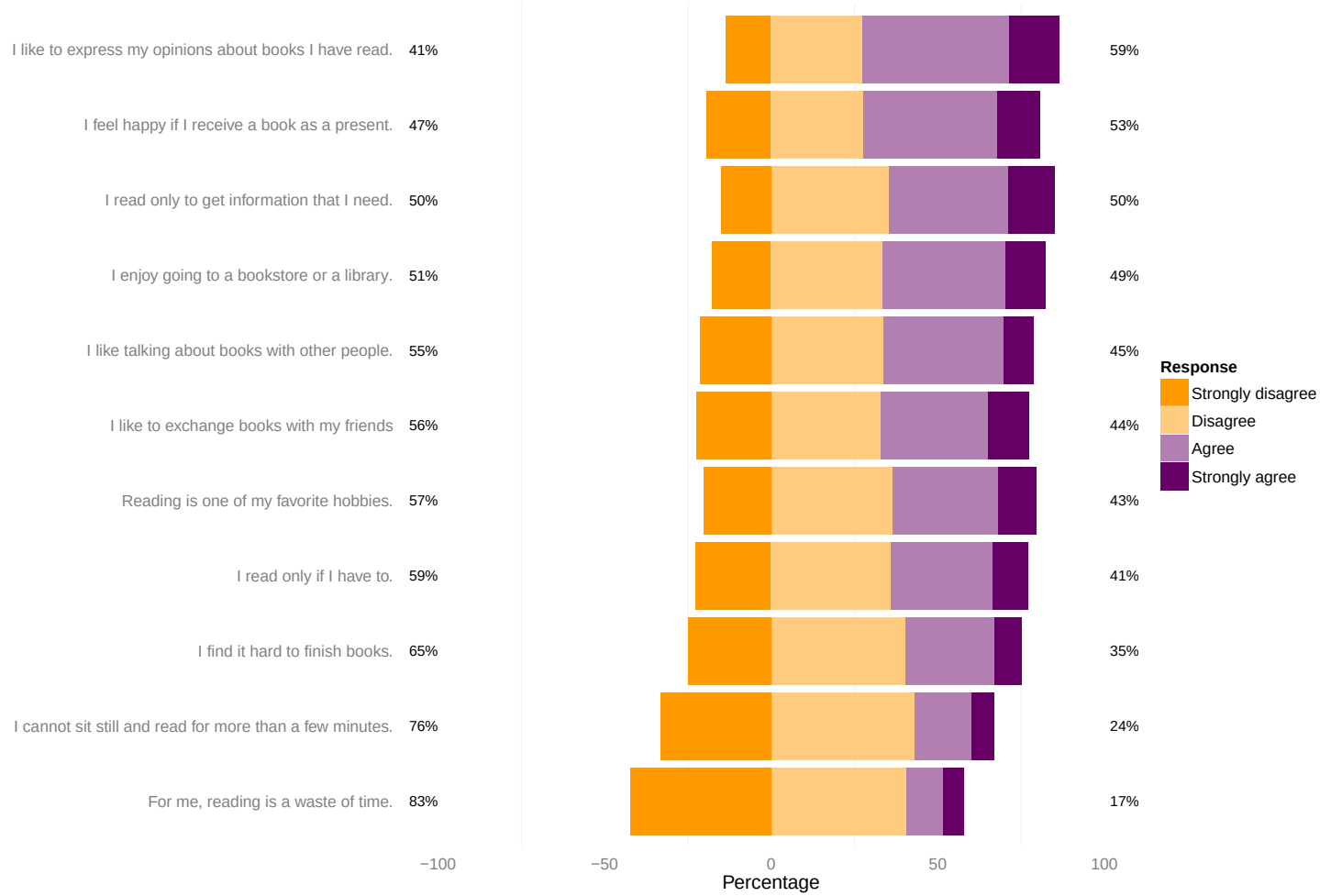
```
> print(plot(128))
```



Bar Plot Centered

The `summary` method will provide provide descriptive statistics.

```
> print(plot(l28, centered=TRUE, low.color="#FF9900", high.color="#6
    )
```



Heat Map

The `summary` method will provide provide descriptive statistics.

```
> print(plot(128, type="heat"))
```