Process: Start with original data. Transform variables, subset or group cases, and join data as needed to create new data sets with the variables needed to display or model.

Sources of Data

Data are available through many sources, but a few data tables are regularly used for examples in DCF. You will usually read the data table into R with the `data()`, or from the Internet with `fetchData()`, or `fetchGapminder()` functions:

```
data(nhanes)
data(OrdwayBirdsOrig)
data(WakeVotersSmall)
```

These create data tables with the indicated name.

Assignment & Naming

Use `<-` or `=` to store an object by name. Use short, mnemonic names. You can use assignment to create copies of existing tables or to read in new ones.

```
birds <- OrdwayBirdsOrig
voters <- WakeVotersSmall
```

Know your Data

Be prepared to answer these questions about any data table:

- What constitutes a **case**?
- How many cases are there?
- What are the **variables**?
- What type is each variable?

```
nrow(birds)
[1] 15829
```

```
ncol(birds)
[1] 26
```

Variable names & Renaming

```
names(voters)
[1] "Age"    "party"  "gender"
```

```
voters <- rename(voters,
                 c(gender="Sex"))
```

Variable types

Check the variables explicitly to avoid mistakes:
`factor` mean categorical

```
class(voters)
[1] "data.frame"
class(voters$Age)
[1] "integer"
class(voters$party)
[1] "factor"
```

Dirty Data

Sometimes data will surprise you:

```
> class(nhanes$sex)
[1] "numeric"
> class(birds$Month)
[1] "factor"
```

You probably thought `sex` would be categorical and `Month` would be numeric.

```
> head(nhanes$sex)
[1] 2 1 2 1 1 2
```

```
levels(birds$Month)
 [1] ""      "1"     "10"    "11"
 [5] "12"    "2"     "25"    "3"
 [9] "4"     "5"     "6"     "7"
[13] "8"     "9"     "Month"
```

Change Type of Variables

Categorical → quantitative

```
birds <- transform(birds,
  Month=as.numeric(
    as.character(Month)))
```

Quantitative → categorical

```
nhanes <- transform(nhanes,
  Sex = factor(sex,
               labels=c("M","F")))
```

```
nhanes <- transform(nhanes,
  agegroup = cut(age,
    breaks=c(0,18,65,100),
    labels=c("Kid","Adult","Sr")))
```

Evenly spaced groups

```
nhanes <- transform(nhanes,
           agegroup=cut(age,3))
```

Evenly populated groups

```
nhanes <- transform(nhanes,
           wtgroup=ntiles(wgt,3))
```

Group Summaries

Specify the variable or variables to use for grouping, and the operations. By default, a count of the number in each group.

```
groupBy(voters,by=party)
  party count
1   DEM  4101
2   REP  3098
3   UNA  2783
```

Median age of voters, by party:

```
groupBy(voters,by=party,
          medage=mean(Age))
  party   medage
1   DEM 46.84638
2   REP 46.43351
3   UNA 40.71398
```

Use > 1 grouping variables.

```
groupBy(voters,
        by=list(party,gender))
```

Subset of Cases

According to a criterion:

```
kids <- subset(nhanes,age<10)
teen <- subset(nhanes,
              age>12 & age<20)
```

Random sample

```
small <- sample(nhanes,size=10)
```

Subset of Variables

```
birds <- subset(OrdwayBirdsOrig,
    select=c("SpeciesName","Month"))
```

Mathematical Transformations

```
nhanes <- transform(nhanes,
            area=wst*hgt)
```

Joining Two Tables

Example: Drop the low-count species of birds.

```
counts <- groupBy(birds,
            by=SpeciesName)
```

	SpeciesName	count
1	Arkansas Kingbird	1.00
2	Bank Swallow	21.00
3	Bay-breasted Warbler	2.00

```
birds <- join(birds,counts)

Joining by:  SpeciesName
```

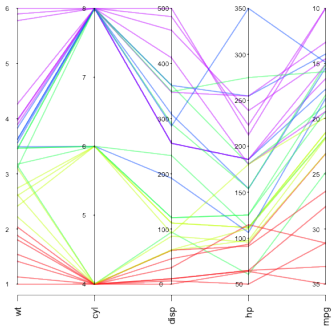
	SpeciesName	Month	count
1	Bank Swallow	6	21.00
2	Bay-breasted Warbler	9	2.00
3	Bank Swallow	7	21.00
4	Bay-breasted Warbler	9	2.00

```
birds <- subset(birds,
           count>200)
```

Choice in `join()`: • Variables to use for matching; • which tables' cases to keep.

Parallel Coordinates

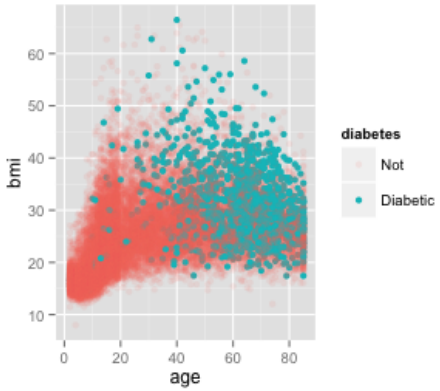
```
parallelPlot(mtcars,
    ~wt + cyl + disp + hp - mpg,
    lwd=5,axes=TRUE)
```



Scatter Plots

To generate interactively:

```
mScatter(nhanes)
```



Required Variables in table:

- x-position: Quant. e.g. `Age`
- y-position: Quant. e.g. `BMI`

Optional variables:

- Size: Quant. or Categorical (not used here)
- Color: Quant. or Categorical, e.g, `diabetes`
- Transluscency `diabetes`

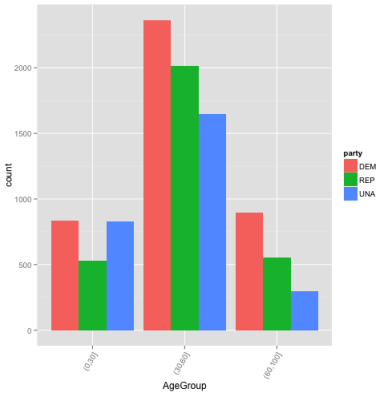
Choices:

- Log axes (not used here)

Bar Plots

Make interactively with

```
mBar(voters)
```



Typically generated from **grouped** data. Required Variables in table:

- x-axis: Categorical e.g. `AgeGroup`
- y-axis: Quant. typically a count.

Optional Variable:

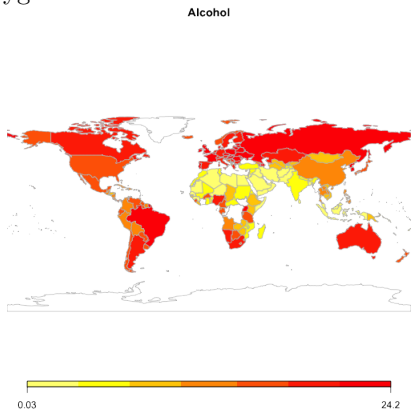
- Sub-divisions of bar groups: Categorical, e.g. `party`

Choices:

- Sub-bar arrangment: stacked, dodged, proportional.

Maps

Choose a program for the geometry of interest. Here, `mWorldMap()`, so the polygons are countries.



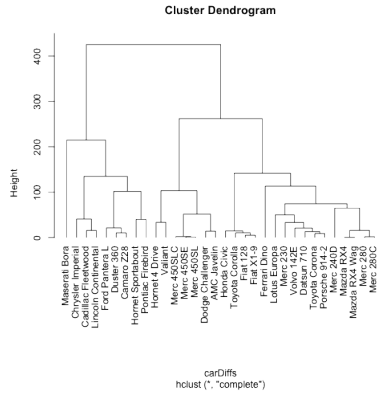
Required Variables in table:

- Polygon: Categorical, here `Country`
- Color: Categ. or Quant.

One case per polygon!

Trees

Find distances between each pair of individual cases.




```
hc <- hclust(dist(mtcars))
plot(hc, hang=-1)
```