Preparing your Data for SEM Estimation

Basic Steps

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Data preparation

1. Data requirements
2. Recoding variables
3. Treating missing values
4. Renaming variables

Data preparation steps

Basic steps:

- Recoding variables
- Treating missing data
- Renaming variables

Advanced steps:

- Examining data distribution
- Removing low quality responses
- Treating outliers

Example data

Quality Expectation	Expectation Products	Problem Expectation	Satisfaction Overall	Expectation Fulfillment
7	rather agree	5	6	NA
10	strongly agree	2	10	10
7	rather agree	4	8	7
7	strongly agree	6	10	NA
8	rather agree	1	10	8
10	agree	4	8	NA

Recoding variables: Numerical

Quality Expectation	Expectation Products	Problem Expectation	Satisfaction Overall	Expectation Fulfillment
7	rather agree	5	6	NA
10	strongly agree	2	10	10
7	rather agree	4	8	7
7	strongly agree	6	10	NA
8	rather agree	1	10	8
10	agree	4	8	NA

Recoding variables: Data type

Data should be

- numerical

But also...

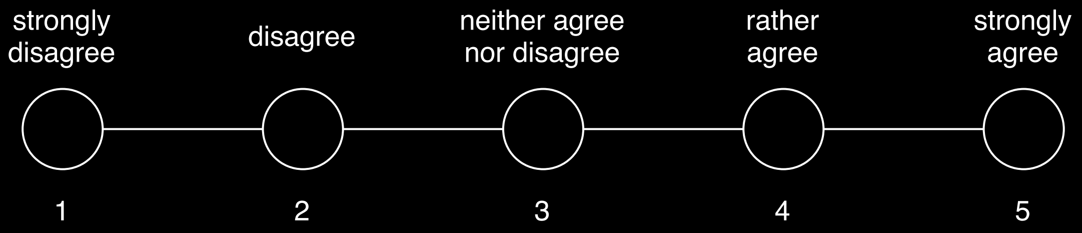
Recoding variables: Data type

Data should be

- numerical

But also...

... approximately equidistant



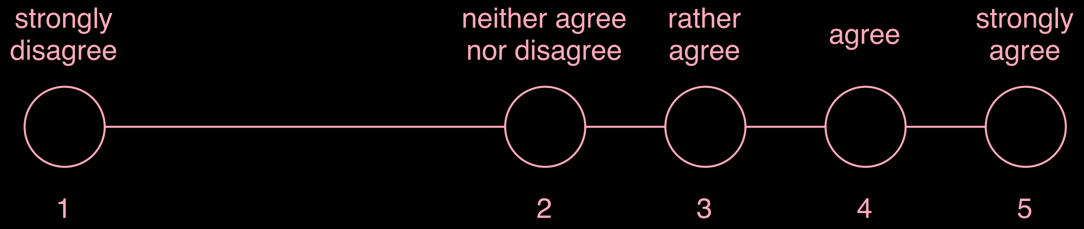
Recoding variables: Data type

Data should be

- numerical

But also…

… approximately equidistant (i.e., not scaled like this)



Recoding variables: Data type

Data should be

- numerical
- ordinal scaled
- and the scale should be approximately equidistant

Recoding variables: Data type

Quality Expectation	Expectation Products	Problem Expectation	Satisfaction Overall	Expectation Fulfillment
7	rather agree	5	6	NA
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7	strongly agree	6	10	NA
8	rather agree	1	10	8
10	agree	4	8	NA

Recoding variables: Data type

```
df <- df %>%                            # assign changes to existing data frame
  dplyr::mutate(                               # add new variable based on existing
    `Expectation Products` =            # name for the new variable
      dplyr::recode(                           # replace values
        `Expectation Products`,         # variable to replace values in
        "rather agree" = 7,             # old value = new value
        "agree" = 9,
        "strongly agree" = 10
      )
  )
# because we gave the new variable the same name,
# it replaces the old variable

# use mutate(across(v1:v3), fnc) to recode variables v1 to v3 using fnc
```

Recoding variables: Data type

Quality Expectation	Expectation Products	Problem Expectation	Satisfaction Overall	Expectation Fulfillment
7	7	5	6	NA
10	10	2	10	10
7	7	4	8	7
7	10	6	10	NA
8	7	1	10	8
10	9	4	8	NA

Recoding variables: Direction

Quality Expectation	Expectation Products	Problem Expectation	Satisfaction Overall	Expectation Fulfillment
7	7	5	6	NA
10	10	2	10	10
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10	9	4	8	NA

Recoding variables: Direction

Expectation			Satisfaction	
Quality Expectation	Expectation Products	Problem Expectation	Satisfaction Overall	Expectation Fulfillment
7	7	5	6	NA
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7	7	4	8	7
7	10	6	10	NA
8	7	1	10	8
10	9	4	8	NA

Recoding variables: Direction

```r
df <- df %>%                      # assign changes to existing data frame
  mutate(                         # add new variable based on existing variables
    `Expectation Products` =      # name for the new variable
      dplyr::recode(              # replace values
        `1` = 10,                 # old value = new value
        `2` = 9,
        `3` = 8,
        `4` = 7,
        `5` = 6,
        `6` = 5,
        `7` = 4,
        `8` = 3,
        `9` = 2,
        `10` = 1
      )
  )
```

Recoding variables: Direction

Quicker option:

```r
# Reverse scale using mutate() with substraction:
# For a scale ranging from 1 to x: x + 1 - scale
# For a scale ranging from 0 to x: x - scale
df <- df %>%
  mutate(
    `Problem Expectation` = 11 - `Problem Expectation`
    )
```

Recoding variables: Direction

Expectation			Satisfaction	
Quality Expectation	Expectation Products	Problem Expectation	Satisfaction Overall	Expectation Fulfillment
7	7	6	6	NA
10	10	9	10	10
7	7	7	8	7
7	10	5	10	NA
8	7	10	10	8
10	9	7	8	NA

Treating missing values

Expectation			Satisfaction	
Quality Expectation	Expectation Products	Problem Expectation	Satisfaction Overall	Expectation Fulfillment
7	7	6	6	NA
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8	7	10	10	8
10	9	7	8	8

Treating missing values

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Treating missing values

- Impute missing data
- Remove variables containing missing data (Hair et al., 2017)
- Ignore missing data

Treating missing values

- Impute missing data
- Remove variables containing missing data (Hair et al., 2017)
- Ignore missing data

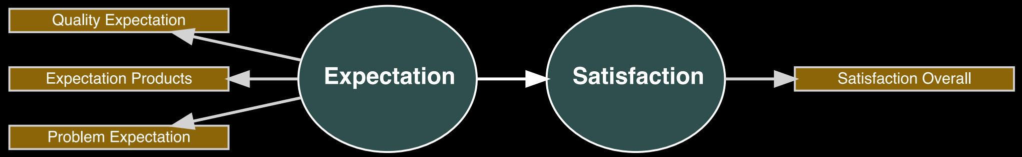
```r
# remove variable with missing data
df <- df %>%
  select(!'Expectation Fulfillment')
```

Renaming variables

Expectation			Satisfaction
Quality Expectation	Expectation Products	Problem Expectation	Satisfaction Overall
7	7	6	6
10	10	9	10
7	7	7	8
7	10	5	10
8	7	10	10
10	9	7	8

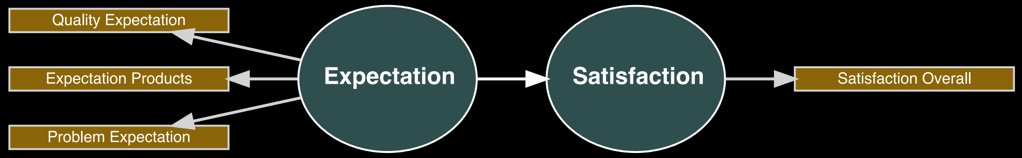
Renaming variables

Long variable names...

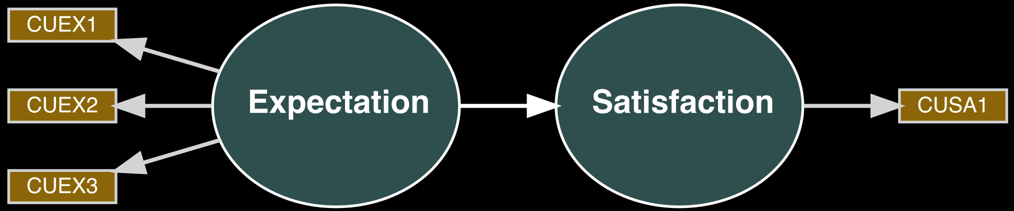


Renaming variables

Long variable names...



... vs. abbreviated names



Renaming variables

Long variable names...

```r
measurement_model <- constructs(    # define measurement model
  reflective(                       # define a reflective construct
    construct_name = "Expectation", # construct name
    item_names = c(                 # item names = df variable names
      "Quality Expectation",
      "Expectation Products",
      "Problem Expectation"
    )
  ),
  reflective(
    construct_name = "Satisfaction",
    item_names = c("Expectation Fulfillment")
  )
)
```

Renaming variables

… vs. abbreviated names

```
measurement_model <- constructs(
  reflective(
    construct_name = "Expectation",
    item_names = multi_items("CUEX", 1:3)    # calls variables with same pre
  ),
  reflective(construct_name = "Satisfaction",
             item_names = "CUSA1")
)
```

Renaming variables

… vs. abbreviated names

```
measurement_model <- constructs(
  reflective(
    construct_name = "Expectation",
    item_names = multi_items("CUEX", 1:3)
  ),
  reflective(construct_name = "Satisfaction",
             item_names = "CUSA1")
)
```

Renaming variables

Rename variables associated with the same construct with the same prefix, e.g. for *CUSA* for *Customer Satisfaction*

```r
df <- df %>%
  rename("CUSA1" = "Satisfaction Overall") # new name = old name
```

Renaming variables

Rename variables associated with the same construct with the same prefix, e.g. for *CUSA* for *Customer Satisfaction*

```r
df <- df %>%
  rename("CUSA1" = "Satisfaction Overall") # new name = old name
```

```r
df <- df %>%
  rename_with(~ paste0("CUEX", 1:3), # function to generate new name
              .cols = c(1:3))         # apply to columns 1 to 3
```

Summary

CUEX1	CUEX2	CUEX3	CUSA1
7	7	6	6
10	10	9	10
7	7	7	8
7	10	5	10
8	7	10	10
10	9	7	8

- Data is numerical and unidirectional
- There are no missing values
- Variables are named for use in SEMinR

Sources for this video

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). A primer on partial least squares structural equation modeling (PLS-SEM) (Second edition). Sage.