520_project

Loading and preocessing the data

```
library(readr)
library(dplyr)
```

```
Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union
```

```
library(tidyr)

# Load ASD scores from two data samples and add a label column
goal_df <- read_csv("asd_goal.csv") %>%
  mutate(sample_type = "goal")
```

```
Rows: 46 Columns: 67

-- Column specification --------------------------------------------------------
Delimiter: ","
dbl (67): id, asd, Q25_1, Q25_2, Q25_3, Q25_4, Q25_5, Q25_6, Q25_7, Q25_8, Q...

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```r
event_df <- read_csv("asd_event.csv") %>%
  mutate(sample_type = "event")
```

```
Rows: 32 Columns: 67
-- Column specification --------------------------------------------------------
Delimiter: ","
dbl (67): id, asd, Q25_1, Q25_2, Q25_3, Q25_4, Q25_5, Q25_6, Q25_7, Q25_8, Q...

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```r
# Combine the two dataframes
combined_df <- bind_rows(goal_df, event_df)

# Remove rows with any NA or empty string ("") values
data_df <- combined_df %>%
  filter(if_all(everything(), ~ !is.na(.) & . != "" & . >= 0))

head(data_df)
```

```
# A tibble: 6 x 68
     id   asd Q25_1 Q25_2 Q25_3 Q25_4 Q25_5 Q25_6 Q25_7 Q25_8 Q25_9 Q25_10
  <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  <dbl>
1 32249    83     4     1     2     1     1     3     4     1     2      1
2 30456    91     2     3     3     2     2     1     3     3     3      2
3 29989    46     2     2     3     1     1     2     3     1     1      2
4 31301    78     2     1     2     1     2     2     3     3     1      3
5 32214    77     4     2     4     4     3     1     4     3     3      1
6 30159    77     4     1     2     2     1     4     4     1     1      1
# i 56 more variables: Q25_11 <dbl>, Q25_12 <dbl>, Q25_13 <dbl>, Q25_14 <dbl>,
#   Q25_15 <dbl>, Q25_16 <dbl>, Q25_17 <dbl>, Q25_18 <dbl>, Q25_19 <dbl>,
#   Q25_20 <dbl>, Q25_21 <dbl>, Q25_22 <dbl>, Q25_23 <dbl>, Q25_24 <dbl>,
#   Q25_25 <dbl>, Q25_26 <dbl>, Q25_27 <dbl>, Q25_28 <dbl>, Q25_29 <dbl>,
#   Q25_30 <dbl>, Q25_31 <dbl>, Q25_32 <dbl>, Q25_33 <dbl>, Q25_34 <dbl>,
#   Q25_35 <dbl>, Q25_36 <dbl>, Q25_37 <dbl>, Q25_38 <dbl>, Q25_39 <dbl>,
#   Q25_40 <dbl>, Q25_41 <dbl>, Q25_42 <dbl>, Q25_43 <dbl>, Q25_44 <dbl>, ...
```

Descriptive Stats

Item-wise Stats

```
library(psych)
library(tidyverse)
```

```
-- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
v forcats   1.0.0     v purrr     1.0.2
v ggplot2   3.5.0     v stringr   1.5.1
v lubridate 1.9.3     v tibble    3.2.1
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x ggplot2::%+%()   masks psych::%+%()
x ggplot2::alpha() masks psych::alpha()
x dplyr::filter()  masks stats::filter()
x dplyr::lag()     masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to becor
```

```
library(dplyr)
library(e1071)

# Item-wise descriptive stats
# Long format data for items
long_items <- data_df %>%
  pivot_longer(cols = starts_with("Q25_"), names_to = "item", values_to = "value")

# Summary stats by sample and item
item_summary <- long_items %>%
  group_by(sample_type, item) %>%
  summarise(
    n = n(),
    mean = mean(value, na.rm = TRUE),
    median = median(value, na.rm = TRUE),
    sd = sd(value, na.rm = TRUE),
    skew = skewness(value, na.rm = TRUE, type = 2),
    kurt = kurtosis(value, na.rm = TRUE, type = 2),
    min = min(value, na.rm = TRUE),
    max = max(value, na.rm = TRUE),
    .groups = "drop"
  )
```

```r
# Sample wise descriptive stats
# Get range of each descriptive stat by sample_type
sample_summary <- item_summary %>%
  group_by(sample_type) %>%
  summarise(
    mean_range = paste0(round(min(mean, na.rm = TRUE), 2), " - ", round(max(mean, na.rm = TRU
    median_range = paste0(round(min(median, na.rm = TRUE), 2), " - ", round(max(median, na.rm
    sd_range = paste0(round(min(sd, na.rm = TRUE), 2), " - ", round(max(sd, na.rm = TRUE), 2)
    skew_range = paste0(round(min(skew, na.rm = TRUE), 2), " - ", round(max(skew, na.rm = TRU
    kurt_range = paste0(round(min(kurt, na.rm = TRUE), 2), " - ", round(max(kurt, na.rm = TRU
  )
```

Composite score stats

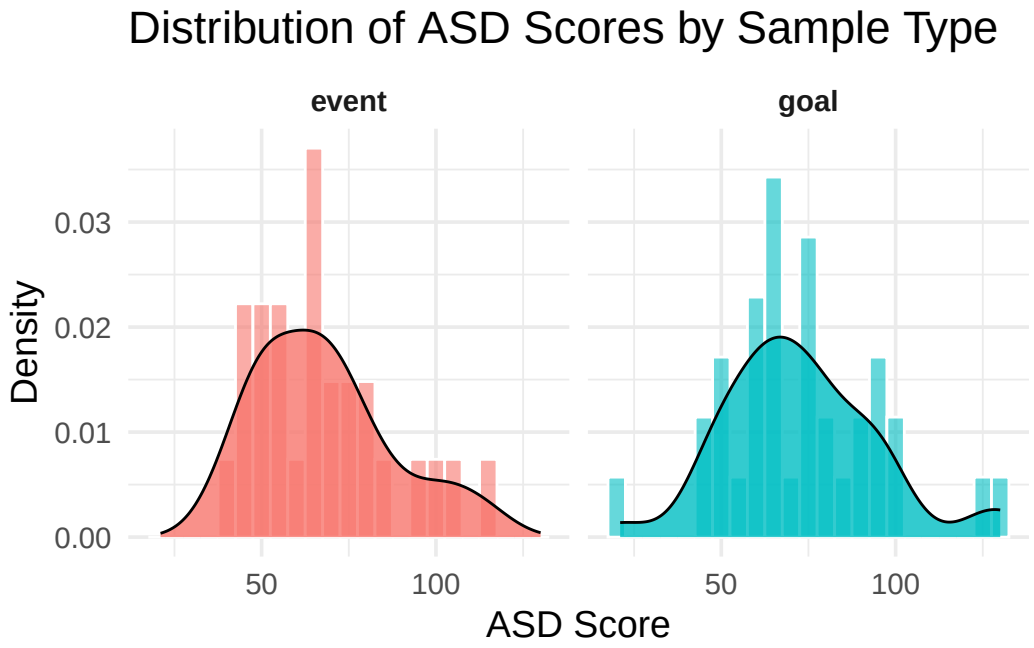
```r
# Compute descriptive statistics for the final ASD score by sample_type
describe_by_sample <- describeBy(data_df$asd, group = data_df$sample_type, mat = TRUE)

# Compute and clean descriptive statistics
describe_df <- describeBy(data_df$asd, group = data_df$sample_type, mat = TRUE) %>%
  as_tibble() %>%
  rename(Sample = group1) %>%
  select(Sample,
         `N` = n,
         `Mean` = mean,
         `SD` = sd,
         `Median` = median,
         `Min` = min,
         `Max` = max,
         `Skewness` = skew,
         `Kurtosis` = kurtosis) %>%
  mutate(across(where(is.numeric), ~ round(., 2)))

# Print in console for copy-pasting into PowerPoint
print(describe_df)
```

```
# A tibble: 2 x 9
  Sample     N  Mean    SD Median   Min   Max Skewness Kurtosis
  <chr>  <dbl> <dbl> <dbl>  <dbl> <dbl> <dbl>    <dbl>    <dbl>
1 event     27  67.7  19.9     65    38   115     0.7     -0.34
2 goal      35  72.7  22.3     71    21   130     0.49     0.54
```

Distribution of composite score

```
library(ggplot2)

# Plot histograms with overlaid density curves
ggplot(data_df, aes(x = asd, fill = sample_type)) +
  geom_histogram(aes(y = ..density..), binwidth = 5, color = "white", alpha = 0.6) +
  geom_density(alpha = 0.8, color = "black") +
  facet_wrap(~sample_type, ncol = 2) +
  theme_minimal(base_size = 14) +
  labs(
    title = "Distribution of ASD Scores by Sample Type",
    x = "ASD Score",
    y = "Density"
  ) +
  theme(
    strip.text = element_text(face = "bold"),
    legend.position = "none"
  )
```

```
Warning: The dot-dot notation (`..density..`) was deprecated in ggplot2 3.4.0.
i Please use `after_stat(density)` instead.
```



Exploratory factor analysis for two samples

```
library(lavaan)
```

```
This is lavaan 0.6-18
lavaan is FREE software! Please report any bugs.


Attaching package: 'lavaan'

The following object is masked from 'package:psych':

    cor2cov
```

```
library(tidyverse)

# Get item names
q25_items <- names(data_df)[str_detect(names(data_df), "^Q25_")]

# Subset goal and event samples
goal_data <- data_df %>% filter(sample_type == "goal") %>% select(all_of(q25_items))
event_data <- data_df %>% filter(sample_type == "event") %>% select(all_of(q25_items))
```

Number of factors

```
# Select only ordinal item columns and ensure no NAs
goal_items <- goal_data %>%
  select(starts_with("Q25_")) %>%
  drop_na()

# Convert to matrix just to be safe
goal_items_matrix <- as.matrix(goal_items)

# Compute polychoric correlation
goal_pcorr <- lavCor(goal_items_matrix, ordered = TRUE)
```

```
Warning: lavaan->lav_data_full():
   small number of observations (nobs < nvar) : nobs = 35 nvar = 65
```

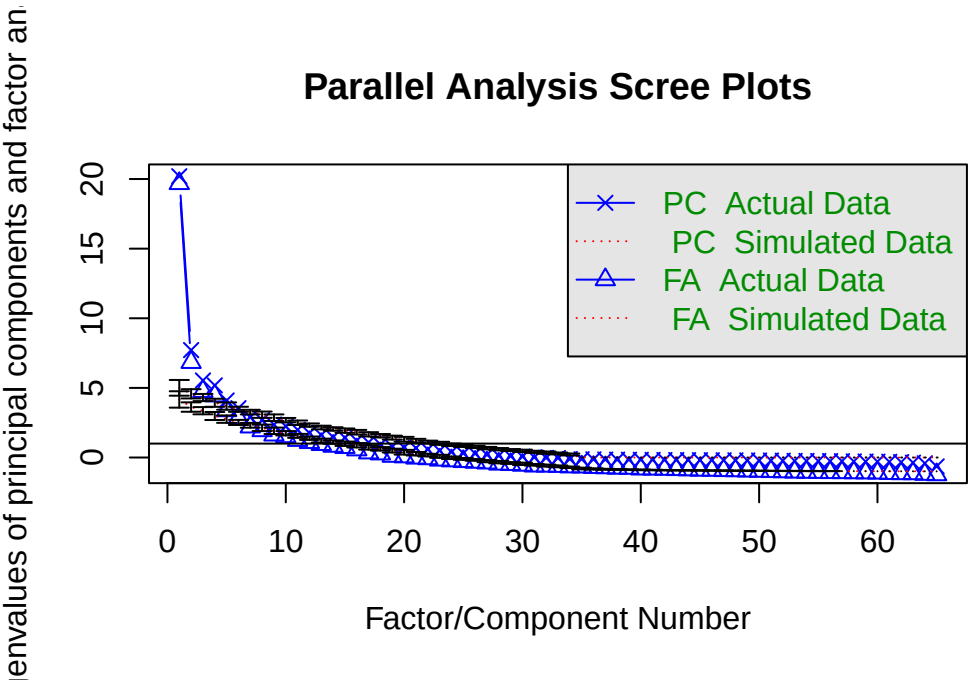
```r
# Number of observations
n_goal <- nrow(goal_items)

suppressWarnings(
  psych::fa.parallel(
    goal_pcorr,
    n.obs = nrow(goal_items),
    fm = "pa",
    error.bars = TRUE
  )
)
```

```
In smc, smcs > 1 were set to 1.0
```

```
In smc, smcs < 0 were set to .0
```

```
The determinant of the smoothed correlation was zero.
This means the objective function is not defined.
Chi square is based upon observed residuals.
```

```
The determinant of the smoothed correlation was zero.
This means the objective function is not defined for the null model either.
The Chi square is thus based upon observed correlations.
```




```
Parallel analysis suggests that the number of factors =  6  and the number of components =  5
```

```r
# Select only ordinal item columns and ensure no NAs
event_items <- event_data %>%
  select(starts_with("Q25_")) %>%
  drop_na()

# Convert to matrix just to be safe
event_items_matrix <- as.matrix(event_items)

# Compute polychoric correlation
event_pcorr <- lavCor(event_items_matrix, ordered = TRUE)
```

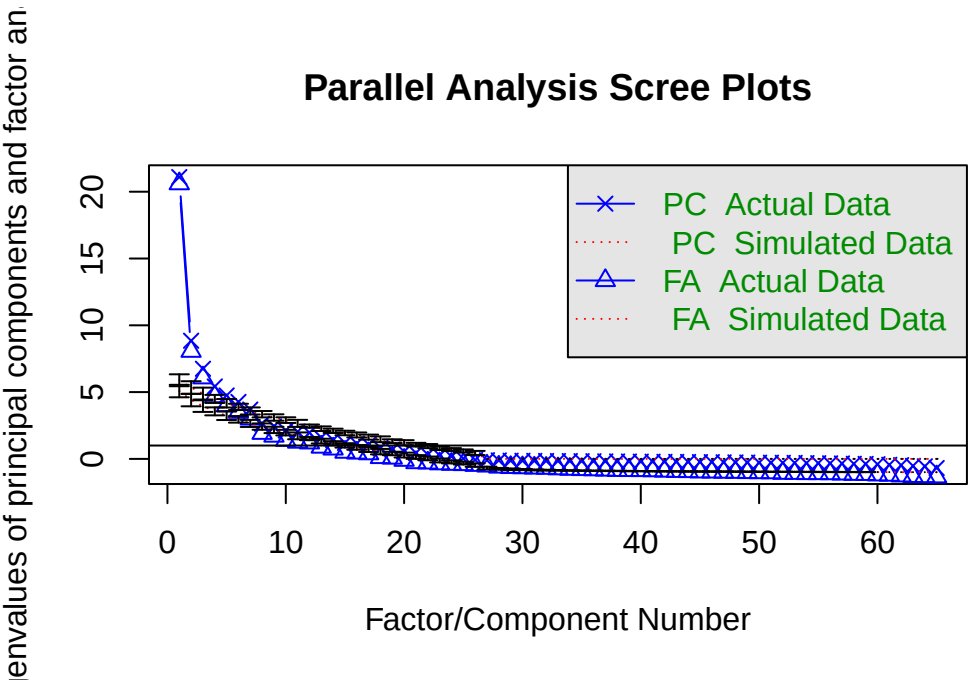
```
Warning: lavaan->lav_data_full():
   small number of observations (nobs < nvar) : nobs = 27 nvar = 65

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_44 and Q25_10 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_44 and Q25_22 is (nearly) 1.0
```

```
Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_38 and Q25_35 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_37 and Q25_36 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_37 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_44 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_54 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_56 and Q25_55 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_61 and Q25_55 is (nearly) 1.0
```

```r
# Number of observations
n_event <- nrow(event_items)

suppressWarnings(
  psych::fa.parallel(
    event_pcorr,
    n.obs = nrow(event_items),
    fm = "pa",
    error.bars = TRUE
  )
)
```

```
In smc, smcs > 1 were set to 1.0

In smc, smcs < 0 were set to .0

The determinant of the smoothed correlation was zero.
This means the objective function is not defined.
Chi square is based upon observed residuals.
```

```
The determinant of the smoothed correlation was zero.
This means the objective function is not defined for the null model either.
The Chi square is thus based upon observed correlations.
```




```
Parallel analysis suggests that the number of factors =  7  and the number of components =  6
```

Both samples suggest number of factors = 4.

EFA for 3-5 factors

```r
# Run EFA with 3 to 5 factors for each, using DWLS for ordinal data
efa_goal <- efa(goal_data, nfactors = 3:5, ordered = TRUE)
```

```
Warning: lavaan->lav_data_full():
   small number of observations (nobs < nvar) : nobs = 35 nvar = 65

Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -2.376731e-13)
```

```
   is smaller than zero. This may be a symptom that the model is not
   identified.

Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -4.396466e-15)
   is smaller than zero. This may be a symptom that the model is not
   identified.

Warning: lavaan->lav_data_full():
   small number of observations (nobs < nvar) : nobs = 35 nvar = 65

Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -5.906763e-13)
   is smaller than zero. This may be a symptom that the model is not
   identified.

Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -2.773009e-14)
   is smaller than zero. This may be a symptom that the model is not
   identified.

Warning: lavaan->lav_object_post_check():
   some estimated ov variances are negative

Warning: lavaan->lav_data_full():
   small number of observations (nobs < nvar) : nobs = 35 nvar = 65

Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -1.238560e-12)
   is smaller than zero. This may be a symptom that the model is not
   identified.

Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -2.701895e-13)
   is smaller than zero. This may be a symptom that the model is not
   identified.
```

```
Warning: lavaan->lav_object_post_check():
   some estimated ov variances are negative
```

```r
efa_event <- efa(event_data, nfactors = 3:5, ordered = TRUE)
```

```
Warning: lavaan->lav_data_full():
   small number of observations (nobs < nvar) : nobs = 27 nvar = 65

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_44 and Q25_10 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_44 and Q25_22 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_38 and Q25_35 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_37 and Q25_36 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_37 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_44 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_54 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_56 and Q25_55 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_61 and Q25_55 is (nearly) 1.0

Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -6.060599e-13)
   is smaller than zero. This may be a symptom that the model is not
   identified.
```

```
Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -2.214590e-13)
   is smaller than zero. This may be a symptom that the model is not
   identified.

Warning: lavaan->lav_data_full():
   small number of observations (nobs < nvar) : nobs = 27 nvar = 65

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_44 and Q25_10 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_44 and Q25_22 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_38 and Q25_35 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_37 and Q25_36 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_37 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_44 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_54 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_56 and Q25_55 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_61 and Q25_55 is (nearly) 1.0

Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -1.220219e-12)
   is smaller than zero. This may be a symptom that the model is not
   identified.
```

```
Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -6.068349e-14)
   is smaller than zero. This may be a symptom that the model is not
   identified.

Warning: lavaan->lav_object_post_check():
   some estimated ov variances are negative

Warning: lavaan->lav_data_full():
   small number of observations (nobs < nvar) : nobs = 27 nvar = 65

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_44 and Q25_10 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_44 and Q25_22 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_38 and Q25_35 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_37 and Q25_36 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_37 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_44 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_55 and Q25_54 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_56 and Q25_55 is (nearly) 1.0

Warning: lavaan->lav_samplestats_step2():
   correlation between variables Q25_61 and Q25_55 is (nearly) 1.0
```

```
Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -1.832702e-12)
   is smaller than zero. This may be a symptom that the model is not
   identified.

Warning: lavaan->lav_model_vcov():
   The variance-covariance matrix of the estimated parameters (vcov) does not
   appear to be positive definite! The smallest eigenvalue (= -2.149590e-14)
   is smaller than zero. This may be a symptom that the model is not
   identified.

Warning: lavaan->lav_object_post_check():
   some estimated ov variances are negative
```

```
summary(efa_goal)
```

```
This is lavaan 0.6-18 -- running exploratory factor analysis

  Estimator                                         DWLS
  Rotation method                         GEOMIN OBLIQUE
  Geomin epsilon                                   0.001
  Rotation algorithm (rstarts)                GPA (30)
  Standardized metric                              TRUE
  Row weights                                      None

  Number of observations                             35

Overview models:
                  chisq   df pvalue   cfi rmsea
  nfactors = 3 2074.758 1888  0.002 0.882 0.054
  nfactors = 4 1981.926 1826  0.006 0.902 0.050
  nfactors = 5 1891.131 1765  0.019 0.920 0.046

Eigenvalues correlation matrix:

      ev1       ev2       ev3       ev4       ev5       ev6       ev7       ev8
  20.2006    7.7146    5.5325    5.1793    4.0974    3.5440    2.8880    2.6904
      ev9      ev10      ev11      ev12      ev13      ev14      ev15      ev16
   2.3669    2.2443    1.9857    1.7548    1.6087    1.4594    1.4159    1.2102
     ev17      ev18      ev19      ev20      ev21      ev22      ev23      ev24
```

```
   1.0809    0.9369    0.7768    0.7192    0.6770    0.5792    0.4931    0.3897
     ev25      ev26      ev27      ev28      ev29      ev30      ev31      ev32
   0.3021    0.2829    0.1988    0.1263    0.0926    0.0614    0.0141   -0.0236
     ev33      ev34      ev35      ev36      ev37      ev38      ev39      ev40
  -0.0376   -0.1146   -0.1239   -0.1334   -0.1442   -0.1540   -0.1613   -0.1651
     ev41      ev42      ev43      ev44      ev45      ev46      ev47      ev48
  -0.1706   -0.1789   -0.1813   -0.1874   -0.1923   -0.1957   -0.1984   -0.2050
     ev49      ev50      ev51      ev52      ev53      ev54      ev55      ev56
  -0.2083   -0.2158   -0.2167   -0.2276   -0.2437   -0.2455   -0.2515   -0.2567
     ev57      ev58      ev59      ev60      ev61      ev62      ev63      ev64
  -0.2666   -0.2794   -0.2885   -0.2939   -0.3070   -0.3301   -0.3697   -0.4157
     ev65
  -0.6397

Number of factors:  3

Standardized loadings: (* = significant at 1% level)

           f1      f2      f3       unique.var   communalities
Q25_1   0.342*       .       .            0.828           0.172
Q25_2        .       .   0.300            0.824           0.176
Q25_3        .  -0.740*                   0.337           0.663
Q25_4                .   0.383*           0.839           0.161
Q25_5  -0.469*           0.422*           0.503           0.497
Q25_6        .   0.439*      .            0.695           0.305
Q25_7   0.900*       .   0.304            0.142           0.858
Q25_8        .           0.559*           0.646           0.354
Q25_9        .       .   0.769*           0.290           0.710
Q25_10       .       .   0.660*           0.468           0.532
Q25_11   0.342  -0.537*      .            0.531           0.469
Q25_12       .               .            0.893           0.107
Q25_13       .   0.632*  0.393            0.422           0.578
Q25_14       .           0.433*           0.687           0.313
Q25_15  0.896*               .            0.240           0.760
Q25_16       .   0.597*  0.608*           0.368           0.632
Q25_17  0.802*   0.456*                   0.239           0.761
Q25_18       .   0.313*  0.779*           0.366           0.634
Q25_19               .   0.657*           0.545           0.455
Q25_20       .       .   0.675*           0.565           0.435
Q25_21  0.769*               .            0.435           0.565
Q25_22  0.611*               .            0.468           0.532
Q25_23       .   0.475*  0.470*           0.529           0.471
Q25_24                   0.668*           0.547           0.453
```

Q25_25	0.377*	.	0.371*	0.750	0.250
Q25_26	0.534*		.	0.627	0.373
Q25_27		0.515*	0.470*	0.539	0.461
Q25_28	0.754*		0.576*	0.300	0.700
Q25_29	.	0.413*	0.554*	0.486	0.514
Q25_30		.	0.808*	0.320	0.680
Q25_31	.		0.483*	0.768	0.232
Q25_32	0.462*	.	-0.447*	0.472	0.528
Q25_33		0.668*	0.635*	0.195	0.805
Q25_34		.*	0.634*	0.575	0.425
Q25_35	.	0.547*	0.512*	0.308	0.692
Q25_36	.		0.820*	0.222	0.778
Q25_37		0.336*	0.786*	0.308	0.692
Q25_38	0.845*	.		0.271	0.729
Q25_39		.	0.731*	0.407	0.593
Q25_40	0.447*	.		0.761	0.239
Q25_41	.		0.693*	0.549	0.451
Q25_42		.	.	0.947	0.053
Q25_43	0.472*	.		0.653	0.347
Q25_44			0.629*	0.602	0.398
Q25_45	0.548*	.		0.685	0.315
Q25_46	-0.400*	-0.351*	0.432*	0.470	0.530
Q25_47	.	.	0.520*	0.658	0.342
Q25_48	0.764*	0.374		0.358	0.642
Q25_49	.		0.628*	0.628	0.372
Q25_50	.		0.779*	0.284	0.716
Q25_51			0.804*	0.324	0.676
Q25_52	.		0.784*	0.417	0.583
Q25_53	.		0.648*	0.460	0.540
Q25_54	.*	.	0.765*	0.171	0.829
Q25_55		.*	0.858*	0.214	0.786
Q25_56	.		0.811*	0.165	0.835
Q25_57		0.493*	0.552*	0.513	0.487
Q25_58			0.520*	0.720	0.280
Q25_59	0.370*	.	0.638*	0.559	0.441
Q25_60	.		0.615*	0.633	0.367
Q25_61	.		0.633*	0.519	0.481
Q25_62	.		0.799*	0.231	0.769
Q25_63	.	.	0.924*	0.000	1.000
Q25_64	0.302	0.792*	0.413*	0.280	0.720
Q25_65	0.478*	.	0.783*	0.340	0.660

	f3	f1	f2	total

```
Sum of sq (obliq) loadings 19.953 8.497 5.453 33.903
Proportion of total         0.589 0.251 0.161  1.000
Proportion var              0.307 0.131 0.084  0.522
Cumulative var              0.307 0.438 0.522  0.522

Factor correlations: (* = significant at 1% level)

       f1      f2      f3
f1  1.000
f2 -0.145   1.000
f3 -0.240  -0.061   1.000

Number of factors:  4

Standardized loadings: (* = significant at 1% level)

           f1      f2      f3      f4       unique.var   communalities
Q25_1       .       .   0.398*  0.418            0.716           0.284
Q25_2       .       .  -0.309       .            0.688           0.312
Q25_3          -0.876*          0.320            0.292           0.708
Q25_4   0.609*              .                    0.540           0.460
Q25_5   0.429          -0.641*      .            0.256           0.744
Q25_6           0.576*                           0.647           0.353
Q25_7          -0.357   0.862*  0.480            0.110           0.890
Q25_8   0.549*      .  -0.338       .            0.369           0.631
Q25_9       .               .   0.745*           0.292           0.708
Q25_10      .       .       .   0.596*           0.435           0.565
Q25_11         -0.711*      .   0.366            0.479           0.521
Q25_12      .               .       .            0.868           0.132
Q25_13  0.374   0.645*                           0.413           0.587
Q25_14      .          -0.336   0.300            0.642           0.358
Q25_15              .   0.895*      .            0.199           0.801
Q25_16  0.802*      .                            0.215           0.785
Q25_17  0.701*          0.631* -0.414            0.067           0.933
Q25_18          0.419*      .   0.667*           0.267           0.733
Q25_19              .           0.720*           0.530           0.470
Q25_20              .       .   0.663*           0.449           0.551
Q25_21              .   0.774*  0.352            0.395           0.605
Q25_22              .   0.566*      .            0.463           0.537
Q25_23          0.658*              .            0.418           0.582
Q25_24      .                   0.742*           0.482           0.518
Q25_25              .   0.342   0.448            0.744           0.256
Q25_26  0.324  -0.415*  0.304       .            0.529           0.471
```

Q25_27	.	0.565*	.	.	0.518	0.482
Q25_28	.	0.760*	0.653		0.248	0.752
Q25_29	0.357	0.417*	.		0.477	0.523
Q25_30			0.824*		0.312	0.688
Q25_31		.	0.513*		0.759	0.241
Q25_32	.	0.385	-0.545*		0.452	0.548
Q25_33	0.815*	0.488	.		0.002	0.998
Q25_34	0.322*		0.543*		0.519	0.481
Q25_35	0.437*	0.539*	.		0.289	0.711
Q25_36	.	.	0.765*		0.202	0.798
Q25_37	.	0.413*	.	0.558*	0.292	0.708
Q25_38	.	0.835*	.		0.254	0.746
Q25_39	.	.	0.718*		0.389	0.611
Q25_40	0.549*	0.307	.		0.609	0.391
Q25_41	.	.	0.614*		0.549	0.451
Q25_42	-0.443*	.	0.425		0.732	0.268
Q25_43	0.301	-0.604*	.		0.490	0.510
Q25_44	.	.	0.580*		0.594	0.406
Q25_45	0.536*	.	0.340	.	0.502	0.498
Q25_46	.	.	-0.394*	0.591*	0.467	0.533
Q25_47	0.517*	-0.468*	0.354		0.397	0.603
Q25_48	0.316	.	0.733*	.	0.354	0.646
Q25_49		.	0.636*		0.599	0.401
Q25_50	0.320	.	0.583*		0.258	0.742
Q25_51	.	.	0.627*		0.318	0.682
Q25_52	0.394*	.	0.627*		0.342	0.658
Q25_53	.	.	0.729*		0.372	0.628
Q25_54		.	0.844*		0.163	0.837
Q25_55	0.489*	.	.	0.559*	0.147	0.853
Q25_56	.	-0.309	0.709*		0.141	0.859
Q25_57	.	0.626*	0.343	0.436	0.324	0.676
Q25_58			0.578*		0.696	0.304
Q25_59	0.311	.	0.357	0.455*	0.551	0.449
Q25_60		.	0.662*		0.581	0.419
Q25_61	.	.	0.750*		0.385	0.615
Q25_62	0.391	.	0.587*		0.146	0.854
Q25_63	.	0.380*	0.933*		-0.158	1.158
Q25_64	0.340	0.748*	0.446*		0.243	0.757
Q25_65	0.499*	0.373*	0.519*		0.315	0.685

	f4	f3	f2	f1	total
Sum of sq (obliq) loadings	16.870	7.847	7.163	6.783	38.662
Proportion of total	0.436	0.203	0.185	0.175	1.000

```
Proportion var              0.260 0.121 0.110 0.104  0.595
Cumulative var              0.260 0.380 0.490 0.595  0.595

Factor correlations: (* = significant at 1% level)

       f1      f2      f3      f4
f1  1.000
f2  0.063   1.000
f3 -0.093  -0.187   1.000
f4  0.319   0.288  -0.271   1.000

Number of factors:  5

Standardized loadings: (* = significant at 1% level)

           f1      f2      f3      f4      f5       unique.var   communalities
Q25_1   0.302  -0.467   0.377                          0.652           0.348
Q25_2           0.415*              .   0.313*          0.623           0.377
Q25_3       .       .       .  -0.815*                  0.272           0.728
Q25_4           0.654*              .                  0.527           0.473
Q25_5  -0.450   0.590*  0.394                          0.212           0.788
Q25_6       .       .           0.550*      .          0.629           0.371
Q25_7   0.882* -0.331               .       .          0.078           0.922
Q25_8           0.609       .       .       .          0.372           0.628
Q25_9               .   0.735*              .          0.249           0.751
Q25_10          0.326       .       .   0.481          0.407           0.593
Q25_11  0.344               .  -0.626*  0.606*          0.242           0.758
Q25_12      .       .  -0.579*              .          0.687           0.313
Q25_13          0.452           0.597*                 0.407           0.593
Q25_14      .       .   0.593*              .          0.527           0.473
Q25_15  0.827* -0.372                                  0.189           0.811
Q25_16      .   0.777*              .                  0.214           0.786
Q25_17  0.728*  0.360       .          -0.428*         0.065           0.935
Q25_18      .               .   0.454*  0.532*         0.242           0.758
Q25_19      .           0.333           0.486*         0.523           0.477
Q25_20      .           0.370   0.339*  0.371          0.439           0.561
Q25_21  0.730*      .       .                          0.395           0.605
Q25_22  0.578*      .  -0.449       .                  0.387           0.613
Q25_23                      .   0.667*      .          0.404           0.596
Q25_24      .               .       .   0.667*         0.408           0.592
Q25_25  0.418*              .       .   0.519*         0.622           0.378
Q25_26  0.413                  -0.398* -0.372          0.485           0.515
Q25_27              .   0.572*  0.551* -0.350*         0.297           0.703
```

Q25_28	0.777*	.	.		0.408	0.234	0.766
Q25_29		0.565	.	0.424	0.538*	0.242	0.758
Q25_30	.		0.499		0.474	0.308	0.692
Q25_31	.	.	0.742*		.	0.513	0.487
Q25_32	0.374		-0.523		.	0.436	0.564
Q25_33		0.840*	.	0.419		0.008	0.992
Q25_34			0.748*	0.348*	.	0.339	0.661
Q25_35	.	0.604*		0.492*	.	0.237	0.763
Q25_36	.		0.710*	.	.	0.172	0.828
Q25_37		.	0.701*	0.450*		0.173	0.827
Q25_38	0.737*	.			-0.421	0.178	0.822
Q25_39			0.801*	.		0.274	0.726
Q25_40	0.448*	0.426*	-0.324			0.569	0.431
Q25_41	.	.	0.511		.	0.529	0.471
Q25_42		-0.380		.	0.416*	0.694	0.306
Q25_43	0.407	.		-0.568*		0.483	0.517
Q25_44			0.670*	.		0.495	0.505
Q25_45	0.512*	0.402	-0.423	.		0.430	0.570
Q25_46	-0.313		0.358	.	0.425	0.461	0.539
Q25_47	.	0.381	0.400	-0.445*		0.361	0.639
Q25_48	0.694*			.	-0.322	0.332	0.668
Q25_49	.		0.538*		.	0.571	0.429
Q25_50		0.488*	.		0.646*	0.161	0.839
Q25_51		.	0.621	.	.	0.288	0.712
Q25_52	.	0.331	0.525	.	.	0.325	0.675
Q25_53				.	0.777*	0.232	0.768
Q25_54	.	.	0.361		0.703*	0.107	0.893
Q25_55	.	0.590*	.	.	0.513*	0.080	0.920
Q25_56	.	0.315	0.591		0.355*	0.126	0.874
Q25_57	.			0.672*	0.521*	0.213	0.787
Q25_58			0.471		.	0.681	0.319
Q25_59	0.447*	.	.	.	.	0.533	0.467
Q25_60	0.357		.		0.600*	0.473	0.527
Q25_61			.	.	0.669*	0.324	0.676
Q25_62		0.499	0.442		0.361	0.140	0.860
Q25_63			0.527	0.457*	0.606*	-0.174	1.174
Q25_64	0.355	.		0.741*		0.247	0.753
Q25_65	0.492	.	0.558*			0.257	0.743

	f3	f5	f1	f2	f4	total
Sum of sq (obliq) loadings	11.592	9.357	7.524	7.274	6.648	42.395
Proportion of total	0.273	0.221	0.177	0.172	0.157	1.000
Proportion var	0.178	0.144	0.116	0.112	0.102	0.652

```
Cumulative var              0.178 0.322 0.438 0.550 0.652  0.652

Factor correlations: (* = significant at 1% level)

       f1      f2      f3      f4      f5
f1  1.000
f2  0.023   1.000
f3  0.021   0.282   1.000
f4  0.010   0.010   0.101   1.000
f5 -0.100   0.103   0.356   0.072   1.000
```

To evaluate the latent structure of the Social Responsiveness Scale items in the goal sample, exploratory factor analyses (EFA) were conducted using the lavaan package with diagonally weighted least squares (DWLS) estimation and geomin oblique rotation. Models specifying three, four, and five factors were compared based on conventional fit indices and explained variance. The three-factor model demonstrated moderate fit, $^{2}(1888) = 2074.76$, p = .002, CFI = .882, RMSEA = .054, and accounted for 52.2% of the total variance. The four-factor model yielded improved fit, $^{2}(1826) = 1981.93$, p = .006, CFI = .902, RMSEA = .050, and explained 59.5% of the variance. The five-factor model demonstrated the best fit, $^{2}(1765) = 1891.13$, p = .019, CFI = .920, RMSEA = .046, and accounted for 65.2% of the variance. Five-factor solution surpassed the CFI > .90 and RMSEA < .05 thresholds and maximized explained variance, supporting its selection as the most appropriate representation of the underlying factor structure.

```
summary(efa_event)
```

```
This is lavaan 0.6-18 -- running exploratory factor analysis

  Estimator                                         DWLS
  Rotation method                         GEOMIN OBLIQUE
  Geomin epsilon                                   0.001
  Rotation algorithm (rstarts)                GPA (30)
  Standardized metric                              TRUE
  Row weights                                      None

  Number of observations                             27

Overview models:
                  chisq   df pvalue   cfi rmsea
  nfactors = 3 2066.743 1888  0.002 0.880  0.06
  nfactors = 4 1944.117 1826  0.027 0.921  0.05
  nfactors = 5 1837.236 1765  0.113 0.951  0.04
```

Eigenvalues correlation matrix:

ev1	ev2	ev3	ev4	ev5	ev6	ev7	ev8
21.0940	8.8445	6.7473	5.4204	4.7466	4.2656	3.6938	2.6372
ev9	ev10	ev11	ev12	ev13	ev14	ev15	ev16
2.4313	2.1313	2.0392	1.9634	1.6001	1.4194	1.2008	1.1480
ev17	ev18	ev19	ev20	ev21	ev22	ev23	ev24
1.0756	0.8242	0.6971	0.5456	0.4451	0.3214	0.2604	0.1747
ev25	ev26	ev27	ev28	ev29	ev30	ev31	ev32
0.0262	-0.0799	-0.0988	-0.1151	-0.1343	-0.1386	-0.1476	-0.1549
ev33	ev34	ev35	ev36	ev37	ev38	ev39	ev40
-0.1613	-0.1635	-0.1704	-0.1753	-0.1857	-0.1924	-0.1965	-0.2056
ev41	ev42	ev43	ev44	ev45	ev46	ev47	ev48
-0.2083	-0.2195	-0.2228	-0.2280	-0.2390	-0.2414	-0.2584	-0.2634
ev49	ev50	ev51	ev52	ev53	ev54	ev55	ev56
-0.2705	-0.2834	-0.2847	-0.2920	-0.2966	-0.3125	-0.3235	-0.3335
ev57	ev58	ev59	ev60	ev61	ev62	ev63	ev64
-0.3433	-0.3658	-0.3770	-0.3986	-0.4429	-0.4661	-0.5227	-0.5552
ev65							
-0.6839							

Number of factors: 3

Standardized loadings: (* = significant at 1% level)

	f1	f2	f3	unique.var	communalities
Q25_1	0.671*		-0.391	0.543	0.457
Q25_2	0.767*			0.452	0.548
Q25_3	.	0.675*		0.471	0.529
Q25_4	0.451*	0.321*	.	0.568	0.432
Q25_5	0.437	0.357	0.304	0.446	0.554
Q25_6	.		.	0.864	0.136
Q25_7	.	0.610*		0.564	0.436
Q25_8	0.688*	0.379		0.276	0.724
Q25_9	0.832*	.		0.224	0.776
Q25_10	0.601*	.	.	0.456	0.544
Q25_11	.	0.647*	.	0.565	0.435
Q25_12	-0.493	0.439*	.	0.597	0.403
Q25_13	0.789*	-0.327		0.398	0.602
Q25_14	0.916*	-0.333	.	0.223	0.777
Q25_15		0.600*	.	0.601	0.399
Q25_16	0.921*		.	0.207	0.793

Q25_17		0.512	-0.409	0.580	0.420
Q25_18	0.570*	-0.572*		0.451	0.549
Q25_19	.		0.596*	0.508	0.492
Q25_20	0.369	0.508*		0.546	0.454
Q25_21	.	0.332	-0.466*	0.681	0.319
Q25_22	.	0.502*	-0.530	0.382	0.618
Q25_23	.		.	0.959	0.041
Q25_24	0.398	0.484*	.	0.480	0.520
Q25_25		0.313*	.	0.886	0.114
Q25_26		0.569*	-0.505	0.427	0.573
Q25_27	0.479*	.		0.753	0.247
Q25_28	0.697*	.		0.457	0.543
Q25_29	0.863*	.		0.069	0.931
Q25_30	0.753*	0.351	.	0.269	0.731
Q25_31	.	0.327	.	0.782	0.218
Q25_32	.		-0.520*	0.753	0.247
Q25_33	0.758*	-0.672*		0.184	0.816
Q25_34	0.672*		0.493	0.098	0.902
Q25_35	0.839*	-0.423	.	0.135	0.865
Q25_36	0.918*	-0.459		0.119	0.881
Q25_37	0.666*	.	0.428	0.214	0.786
Q25_38	-0.539*	0.416*	-0.457	0.266	0.734
Q25_39	0.383	0.374*	0.501*	0.281	0.719
Q25_40	.	0.435	-0.604*	0.437	0.563
Q25_41	0.596*	.		0.599	0.401
Q25_42	0.563*	0.394*		0.432	0.568
Q25_43	.	0.399*		0.810	0.190
Q25_44	0.600*	.	0.556	0.139	0.861
Q25_45	0.312	0.370	-0.688*	0.398	0.602
Q25_46	0.592*		0.608	0.058	0.942
Q25_47	0.328		0.472*	0.564	0.436
Q25_48		0.521	-0.829*	0.065	0.935
Q25_49	0.522*		0.316	0.502	0.498
Q25_50	0.823*	0.311	.	0.006	0.994
Q25_51	0.639*	-0.597*	.	0.284	0.716
Q25_52	.	0.454	0.436*	0.443	0.557
Q25_53	.		0.727*	0.317	0.683
Q25_54	0.303	0.410	0.629*	0.168	0.832
Q25_55	.		0.893*	0.025	0.975
Q25_56	0.342	.	0.708*	0.111	0.889
Q25_57			0.624*	0.628	0.372
Q25_58	.		0.770*	0.446	0.554
Q25_59		0.577*	0.617*	0.262	0.738

```
Q25_60      .           0.856*           0.314           0.686
Q25_61              .   0.911*           0.163           0.837
Q25_62          0.422   0.752*           0.235           0.765
Q25_63              .   0.811*           0.325           0.675
Q25_64      .       .   0.440*           0.722           0.278
Q25_65              .   0.436*           0.744           0.256

                              f1     f3    f2  total
Sum of sq (obliq) loadings 16.266 13.429 8.372 38.066
Proportion of total         0.427  0.353 0.220  1.000
Proportion var              0.250  0.207 0.129  0.586
Cumulative var              0.250  0.457 0.586  0.586

Factor correlations: (* = significant at 1% level)

       f1      f2      f3
f1  1.000
f2  0.179   1.000
f3  0.309   0.029   1.000

Number of factors:  4

Standardized loadings: (* = significant at 1% level)

           f1      f2      f3      f4       unique.var   communalities
Q25_1           0.493*  0.546*      .            0.512           0.488
Q25_2           0.651*  0.378                    0.422           0.578
Q25_3   0.758*      .       .                    0.383           0.617
Q25_4               .   0.473*  0.432            0.426           0.574
Q25_5   0.733*      .       .       .            0.215           0.785
Q25_6       .       .       .   0.334            0.801           0.199
Q25_7       .       .   0.559*      .            0.514           0.486
Q25_8   0.761*  0.364                            0.146           0.854
Q25_9   0.514*  0.635*      .                    0.139           0.861
Q25_10      .   0.600*              .            0.413           0.587
Q25_11  0.806* -0.415               .            0.338           0.662
Q25_12      .  -0.636*                           0.589           0.411
Q25_13      .   0.799*      .*                   0.362           0.638
Q25_14          0.922*      .       .            0.209           0.791
Q25_15         -0.344   0.562*      .            0.530           0.470
Q25_16          0.781*  0.512*                   0.132           0.868
Q25_17      .       .   0.824*      .            0.251           0.749
Q25_18 -0.418*  0.746*                           0.412           0.588
```

Q25_19	-0.409	0.345		0.655*	0.364	0.636
Q25_20	.		0.525*	.	0.494	0.506
Q25_21			0.632*	.	0.586	0.414
Q25_22		-0.493*	0.637*	.	0.249	0.751
Q25_23	-0.360		0.509*	.	0.636	0.364
Q25_24	0.458*	.	.	.	0.469	0.531
Q25_25	.	.	.	.	0.888	0.112
Q25_26	.	-0.360	0.596*	.	0.408	0.592
Q25_27		0.331	0.419*	.	0.682	0.318
Q25_28	.	0.510*	0.463*		0.411	0.589
Q25_29	0.680*	0.614*			-0.018	1.018
Q25_30	0.412*	0.460*	0.518*		0.231	0.769
Q25_31	.		0.459*	0.400*	0.608	0.392
Q25_32		.	0.345	-0.408	0.758	0.242
Q25_33	-0.351	0.943*		.	0.177	0.823
Q25_34	.	0.623*		0.493*	0.086	0.914
Q25_35	.	0.927*		.	0.115	0.885
Q25_36	.	0.978*	.		0.104	0.896
Q25_37		0.669*		0.418	0.206	0.794
Q25_38		-0.684*	0.326	.	0.251	0.749
Q25_39	.	.	.	0.629*	0.265	0.735
Q25_40	.		0.773*	.	0.335	0.665
Q25_41	.	0.460*	.		0.585	0.415
Q25_42	0.465*	.	0.324	.	0.403	0.597
Q25_43			0.504*	.	0.660	0.340
Q25_44	.	0.632*	-0.317	0.395	0.055	0.945
Q25_45			0.819*	-0.332	0.277	0.723
Q25_46		0.567*		0.614*	0.044	0.956
Q25_47	.	.	.	0.361	0.508	0.492
Q25_48	0.335	-0.324	0.669*	-0.581*	0.036	0.964
Q25_49		0.456	.	0.421*	0.468	0.532
Q25_50	0.612*	0.545*		.	0.007	0.993
Q25_51	.	0.833*	.		0.279	0.721
Q25_52	0.359		.	0.543*	0.427	0.573
Q25_53	.	.		0.780*	0.252	0.748
Q25_54	.	.		0.727*	0.155	0.845
Q25_55	.	.	-0.317	0.833*	0.005	0.995
Q25_56	0.456	.	.	0.651*	0.044	0.956
Q25_57	-0.345			0.716*	0.506	0.494
Q25_58	.		.	0.790*	0.400	0.600
Q25_59	.	.	.	0.780*	0.245	0.755
Q25_60	-0.522			0.989*	0.047	0.953
Q25_61	.		.	0.991*	0.097	0.903

```
Q25_62  0.308       .       .   0.796*           0.210           0.790
Q25_63      .          -0.423   0.711*           0.259           0.741
Q25_64 -0.752*                   0.574*           0.353           0.647
Q25_65      .               .   0.412*           0.726           0.274

                              f2     f4    f3    f1  total
Sum of sq (obliq) loadings 14.243 12.800 8.210 7.602 42.854
Proportion of total         0.332  0.299 0.192 0.177  1.000
Proportion var              0.219  0.197 0.126 0.117  0.659
Cumulative var              0.219  0.416 0.542 0.659  0.659

Factor correlations: (* = significant at 1% level)

       f1      f2      f3      f4
f1  1.000
f2  0.235   1.000
f3  0.123  -0.044   1.000
f4  0.286   0.312   0.085   1.000

Number of factors:  5

Standardized loadings: (* = significant at 1% level)

           f1      f2      f3      f4      f5       unique.var   communalities
Q25_1       .   0.557*  0.435                .            0.516           0.484
Q25_2           0.733*      .                            0.408           0.592
Q25_3   0.790*      .       .       .                    0.183           0.817
Q25_4           0.396   0.475*      .   0.349            0.342           0.658
Q25_5   0.552*      .          -0.418       .            0.213           0.787
Q25_6           0.331           0.449*  0.309            0.597           0.403
Q25_7                   0.653*               .            0.502           0.498
Q25_8   0.552   0.473       .  -0.378                    0.132           0.868
Q25_9   0.356   0.744*      .       .                    0.115           0.885
Q25_10      .   0.690*      .               .            0.298           0.702
Q25_11  0.897*      .               .       .            0.123           0.877
Q25_12  0.573* -0.452           0.455*                   0.242           0.758
Q25_13      .   0.838*              .*                   0.303           0.697
Q25_14      .   0.882*              .       .            0.171           0.829
Q25_15      .       .   0.460*  0.472*                   0.418           0.582
Q25_16      .   0.827*  0.418                            0.123           0.877
Q25_17                  0.727*  0.677*                   0.074           0.926
Q25_18 -0.422*  0.664*      .       .                    0.399           0.601
Q25_19 -0.478       .                   0.607*           0.317           0.683
```

Q25_20	.	.	0.645*	-0.330		0.394	0.606
Q25_21	.		0.639*		.	0.556	0.444
Q25_22	.	-0.437*	0.720*	.	.	0.203	0.797
Q25_23	-0.470*		0.526*	.	.	0.598	0.402
Q25_24	0.432	.	0.318*		.	0.395	0.605
Q25_25	.		.		.	0.871	0.129
Q25_26	.	.	0.632*	.	.	0.377	0.623
Q25_27	-0.434*	.	0.483*	-0.354		0.410	0.590
Q25_28		0.582*	0.432*			0.409	0.591
Q25_29	0.473	0.701*		-0.375		-0.025	1.025
Q25_30		0.550*	0.551*	.		0.200	0.800
Q25_31	.	.	0.529*		0.317	0.577	0.423
Q25_32	.	.	.	0.405	-0.440	0.586	0.414
Q25_33	-0.445	0.838*	.		.	0.157	0.843
Q25_34	.	0.712*		.	0.476*	0.013	0.987
Q25_35	.	0.958*	.	.	.	0.037	0.963
Q25_36	.	0.966*		.		0.097	0.903
Q25_37		0.705*			0.431	0.181	0.819
Q25_38		-0.651*	0.408*		-0.325	0.240	0.760
Q25_39		.	.*	.	0.578*	0.260	0.740
Q25_40		.	0.704*	0.302	-0.351	0.292	0.708
Q25_41		0.508*	.	.		0.579	0.421
Q25_42		0.339	0.484*	-0.538*		0.202	0.798
Q25_43	.		0.590*		.	0.627	0.373
Q25_44		0.589*	.	-0.385*	0.449	0.005	0.995
Q25_45	-0.303	.	0.803*		-0.480	0.187	0.813
Q25_46		0.611*			0.617*	0.028	0.972
Q25_47		.	.	-0.460*	0.387*	0.416	0.584
Q25_48	.	.	0.686*		-0.671*	0.018	0.982
Q25_49		0.539*	.	.	0.372*	0.423	0.577
Q25_50	0.313	0.617*	.	-0.447*	.	-0.013	1.013
Q25_51	.	0.740*	-0.342			0.275	0.725
Q25_52			0.353	-0.613*	0.459*	0.175	0.825
Q25_53		0.329*		0.370	0.755*	0.154	0.846
Q25_54	.	.	.		0.694*	0.131	0.869
Q25_55		.	.	-0.366	0.847*	-0.070	1.070
Q25_56	.	.		-0.507*	0.645*	0.011	0.989
Q25_57	.			0.411	0.696*	0.421	0.579
Q25_58	.				0.784*	0.371	0.629
Q25_59		.	0.425	-0.418	0.706*	0.085	0.915
Q25_60	.			0.507	0.942*	-0.014	1.014
Q25_61	.				0.964*	0.075	0.925
Q25_62	.	.	.	-0.333	0.778*	0.178	0.822

```
Q25_63  0.425*         -0.336           0.774*           0.136           0.864
Q25_64 -0.588                   0.477   0.547*           0.297           0.703
Q25_65      .*                          0.449*           0.678           0.322

                               f2     f5    f3    f1    f4  total
Sum of sq (obliq) loadings 14.826 12.510 8.430 5.801 5.756 47.323
Proportion of total         0.313  0.264 0.178 0.123 0.122  1.000
Proportion var              0.228  0.192 0.130 0.089 0.089  0.728
Cumulative var              0.228  0.421 0.550 0.639 0.728  0.728

Factor correlations: (* = significant at 1% level)

       f1      f2      f3      f4      f5
f1  1.000
f2  0.134   1.000
f3  0.233   0.094   1.000
f4  0.036  -0.167  -0.039   1.000
f5  0.112   0.285*  0.082  -0.151   1.000
```

To examine the latent structure of the Social Responsiveness Scale items in the event sample, exploratory factor analyses (EFA) were conducted using the lavaan package with DWLS estimation and geomin oblique rotation. Competing models specifying three, four, and five factors were evaluated based on multiple fit indices and explained variance. The three-factor solution demonstrated modest fit, $^2(1888) = 2066.74$, p = .002, CFI = .880, RMSEA = .060, explaining 58.6% of the variance. The four-factor model improved upon this, $^2(1826) = 1944.12$, p = .027, CFI = .921, RMSEA = .050, and explained 65.9% of the variance. The five-factor model yielded the best fit: $^2(1765) = 1837.24$, p = .113, CFI = .951, RMSEA = .040, and accounted for 72.8% of the total variance. As the five-factor solution provided the most acceptable fit (non-significant ^{2}, highest CFI, lowest RMSEA) and the greatest proportion of explained variance, it was selected as the optimal model for the event sample.

Across both the goal and event samples, exploratory factor analyses indicated that five-factor solutions provided the best overall fit.

Making sense of the loadings

```
library(flextable)
```

```
Attaching package: 'flextable'
```

```
The following object is masked from 'package:purrr':

    compose
```

```r
library(dplyr)
library(tibble)

efa_goal_5 <- efa_goal[[3]]  # 3rd model = 5-factor solution

goal_loadings <- inspect(efa_goal_5, "std")$lambda |>
  as.data.frame() |>
  rownames_to_column("item")

flextable(goal_loadings) |>
  bold(i = ~ abs(f1) >= .30, j = "f1") |>
  bold(i = ~ abs(f2) >= .30, j = "f2") |>
  bold(i = ~ abs(f3) >= .30, j = "f3") |>
  bold(i = ~ abs(f4) >= .30, j = "f4") |>
  bold(i = ~ abs(f5) >= .30, j = "f5") |>
  set_formatter(
    f1 = function(x) formatC(x, digits = 2, format = "f"),
    f2 = function(x) formatC(x, digits = 2, format = "f"),
    f3 = function(x) formatC(x, digits = 2, format = "f"),
    f4 = function(x) formatC(x, digits = 2, format = "f"),
    f5 = function(x) formatC(x, digits = 2, format = "f")
  ) |>
  set_header_labels(values = c("item" = "Item", "f1" = "1", "f2" = "2", "f3" = "3", "f4" = "4
  add_header_row(values = c("", "Factor Loadings"), colwidths = c(1, 5)) |>
  align(i = 1, align = "center", part = "header")
```

	Factor Loadings				
Item	1	2	3	4	5
Q25_1	**0.30**	**-0.47**	**0.38**	-0.07	-0.02
Q25_2	-0.08	**0.41**	-0.01	-0.30	**0.31**
Q25_3	0.19	-0.18	0.26	**-0.82**	0.02
Q25_4	0.00	**0.65**	0.02	-0.13	0.09
Q25_5	**-0.45**	**0.59**	**0.39**	-0.03	-0.07
Q25_6	-0.10	0.15	-0.05	**0.55**	0.16

	Factor Loadings				
Item	1	2	3	4	5
Q25_7	**0.88**	**-0.33**	-0.01	-0.21	0.29
Q25_8	-0.05	**0.61**	0.24	-0.22	0.18
Q25_9	-0.10	0.12	**0.73**	-0.03	0.20
Q25_10	-0.02	**0.33**	0.28	-0.12	**0.48**
Q25_11	**0.34**	0.01	-0.24	**-0.63**	**0.61**
Q25_12	0.22	0.18	**-0.58**	-0.00	0.19
Q25_13	-0.04	**0.45**	0.03	**0.60**	0.06
Q25_14	-0.24	0.23	**0.59**	-0.03	-0.14
Q25_15	**0.83**	**-0.37**	0.09	-0.05	-0.04
Q25_16	0.23	**0.78**	0.07	0.24	0.07
Q25_17	**0.73**	**0.36**	-0.19	0.00	**-0.43**
Q25_18	0.23	0.10	0.24	**0.45**	**0.53**
Q25_19	0.15	0.03	**0.33**	-0.06	**0.49**
Q25_20	0.23	-0.05	**0.37**	**0.34**	**0.37**
Q25_21	**0.73**	-0.29	0.13	-0.02	0.05
Q25_22	**0.58**	-0.16	**-0.45**	-0.14	0.01
Q25_23	-0.03	0.07	0.21	**0.67**	0.16
Q25_24	0.13	-0.01	0.18	0.12	**0.67**
Q25_25	**0.42**	-0.03	-0.10	-0.12	**0.52**
Q25_26	**0.41**	0.06	0.01	**-0.40**	**-0.37**
Q25_27	-0.00	0.14	**0.57**	**0.55**	**-0.35**
Q25_28	**0.78**	-0.18	0.14	-0.00	**0.41**
Q25_29	0.02	**0.56**	-0.23	**0.42**	**0.54**
Q25_30	0.12	0.10	**0.50**	-0.02	**0.47**
Q25_31	0.16	-0.19	**0.74**	0.00	-0.20
Q25_32	**0.37**	0.04	**-0.52**	-0.06	-0.23

	Factor Loadings				
Item	1	2	3	4	5
Q25_33	0.06	**0.84**	0.15	**0.42**	-0.01
Q25_34	0.01	-0.05	**0.75**	**0.35**	-0.11
Q25_35	-0.14	**0.60**	-0.00	**0.49**	0.28
Q25_36	-0.12	0.07	**0.71**	0.20	0.25
Q25_37	0.06	0.13	**0.70**	**0.45**	-0.01
Q25_38	**0.74**	-0.23	0.09	0.06	**-0.42**
Q25_39	0.04	0.06	**0.80**	-0.17	0.07
Q25_40	**0.45**	**0.43**	**-0.32**	-0.03	-0.06
Q25_41	0.21	0.11	**0.51**	0.06	0.20
Q25_42	0.04	**-0.38**	0.02	0.12	**0.42**
Q25_43	**0.41**	0.11	-0.01	**-0.57**	-0.08
Q25_44	0.02	-0.01	**0.67**	0.15	0.03
Q25_45	**0.51**	**0.40**	**-0.42**	-0.20	-0.03
Q25_46	**-0.31**	-0.00	**0.36**	-0.15	**0.43**
Q25_47	0.28	**0.38**	**0.40**	**-0.44**	0.01
Q25_48	**0.69**	-0.00	-0.08	0.15	**-0.32**
Q25_49	0.20	-0.06	**0.54**	0.10	0.17
Q25_50	-0.03	**0.49**	0.13	0.02	**0.65**
Q25_51	0.02	0.27	**0.62**	0.14	0.18
Q25_52	0.22	**0.33**	**0.52**	-0.14	0.22
Q25_53	-0.01	-0.05	0.07	0.29	**0.78**
Q25_54	-0.14	0.11	**0.36**	-0.01	**0.70**
Q25_55	0.11	**0.59**	0.23	0.12	**0.51**
Q25_56	-0.14	**0.31**	**0.59**	-0.01	**0.36**
Q25_57	0.23	-0.00	-0.04	**0.67**	**0.52**
Q25_58	0.06	-0.10	**0.47**	0.07	0.19

	Factor Loadings				
Item	1	2	3	4	5
Q25_59	**0.45**	0.22	0.18	0.17	0.29
Q25_60	**0.36**	0.00	0.12	0.08	**0.60**
Q25_61	-0.02	-0.08	0.23	0.22	**0.67**
Q25_62	-0.08	**0.50**	**0.44**	0.01	**0.36**
Q25_63	-0.04	-0.00	**0.53**	**0.46**	**0.61**
Q25_64	**0.36**	0.26	-0.02	**0.74**	0.02
Q25_65	**0.49**	0.28	**0.56**	0.07	-0.03

```
efa_event_5 <- efa_event[[3]]  # 3rd model = 5-factor solution

event_loadings <- inspect(efa_event_5, "std")$lambda |>
  as.data.frame() |>
  rownames_to_column("item")

flextable(event_loadings) |>
  bold(i = ~ abs(f1) >= .30, j = "f1") |>
  bold(i = ~ abs(f2) >= .30, j = "f2") |>
  bold(i = ~ abs(f3) >= .30, j = "f3") |>
  bold(i = ~ abs(f4) >= .30, j = "f4") |>
  bold(i = ~ abs(f5) >= .30, j = "f5") |>
  set_formatter(
    f1 = function(x) formatC(x, digits = 2, format = "f"),
    f2 = function(x) formatC(x, digits = 2, format = "f"),
    f3 = function(x) formatC(x, digits = 2, format = "f"),
    f4 = function(x) formatC(x, digits = 2, format = "f"),
    f5 = function(x) formatC(x, digits = 2, format = "f")
  ) |>
  set_header_labels(values = c("item" = "Item", "f1" = "1", "f2" = "2", "f3" = "3", "f4" = "
  add_header_row(values = c("", "Factor Loadings"), colwidths = c(1, 5)) |>
  align(i = 1, align = "center", part = "header")
```

	Factor Loadings				
Item	1	2	3	4	5
Q25_1	-0.15	**0.56**	**0.44**	0.06	-0.25
Q25_2	-0.04	**0.73**	0.25	0.09	-0.04
Q25_3	**0.79**	0.12	0.17	0.16	0.09
Q25_4	0.01	**0.40**	**0.48**	0.30	**0.35**
Q25_5	**0.55**	0.29	0.02	**-0.42**	0.23
Q25_6	0.06	**0.33**	0.08	**0.45**	**0.31**
Q25_7	0.06	0.00	**0.65**	0.09	0.17
Q25_8	**0.55**	**0.47**	0.16	**-0.38**	-0.01
Q25_9	**0.36**	**0.74**	0.13	-0.20	-0.01
Q25_10	0.29	**0.69**	-0.23	0.08	0.19
Q25_11	**0.90**	-0.12	-0.01	0.24	-0.13
Q25_12	**0.57**	**-0.45**	0.01	**0.45**	0.00
Q25_13	-0.23	**0.84**	0.06	0.28	-0.03
Q25_14	-0.25	**0.88**	0.06	-0.20	-0.21
Q25_15	0.29	-0.11	**0.46**	**0.47**	0.05
Q25_16	-0.24	**0.83**	**0.42**	-0.01	-0.02
Q25_17	-0.07	-0.00	**0.73**	**0.68**	0.02
Q25_18	**-0.42**	**0.66**	-0.22	0.15	0.03
Q25_19	**-0.48**	0.26	0.02	-0.08	**0.61**
Q25_20	-0.12	0.14	**0.65**	**-0.33**	0.10
Q25_21	-0.23	0.01	**0.64**	0.00	-0.26
Q25_22	-0.19	**-0.44**	**0.72**	0.11	-0.27
Q25_23	**-0.47**	-0.01	**0.53**	0.16	0.11
Q25_24	**0.43**	0.29	**0.32**	0.00	0.23
Q25_25	0.21	-0.04	0.16	0.06	0.19
Q25_26	0.17	-0.19	**0.63**	0.22	-0.28

	Factor Loadings				
Item	1	2	3	4	5
Q25_27	**-0.43**	0.29	**0.48**	**-0.35**	0.01
Q25_28	-0.06	**0.58**	**0.43**	-0.07	0.03
Q25_29	**0.47**	**0.70**	-0.00	**-0.37**	0.01
Q25_30	0.07	**0.55**	**0.55**	-0.27	-0.08
Q25_31	-0.27	0.11	**0.53**	0.06	**0.32**
Q25_32	0.11	0.26	0.16	**0.40**	**-0.44**
Q25_33	**-0.45**	**0.84**	-0.24	-0.00	-0.15
Q25_34	0.20	**0.71**	-0.01	0.14	**0.48**
Q25_35	-0.15	**0.96**	-0.17	0.22	0.13
Q25_36	-0.27	**0.97**	-0.06	0.20	-0.02
Q25_37	-0.02	**0.70**	-0.09	0.07	**0.43**
Q25_38	0.00	**-0.65**	**0.41**	0.05	**-0.32**
Q25_39	0.07	0.28	0.29	-0.17	**0.58**
Q25_40	0.06	0.16	**0.70**	**0.30**	**-0.35**
Q25_41	0.10	**0.51**	0.21	-0.17	0.01
Q25_42	0.00	**0.34**	**0.48**	**-0.54**	0.09
Q25_43	-0.25	-0.03	**0.59**	-0.02	0.16
Q25_44	0.01	**0.59**	-0.28	**-0.39**	**0.45**
Q25_45	**-0.30**	0.11	**0.80**	-0.03	**-0.48**
Q25_46	0.03	**0.61**	-0.03	0.00	**0.62**
Q25_47	0.06	0.26	-0.11	**-0.46**	**0.39**
Q25_48	0.17	-0.20	**0.69**	-0.02	**-0.67**
Q25_49	-0.01	**0.54**	0.17	0.22	**0.37**
Q25_50	**0.31**	**0.62**	0.17	**-0.45**	0.16
Q25_51	-0.29	**0.74**	**-0.34**	-0.04	0.06
Q25_52	-0.09	-0.00	**0.35**	**-0.61**	**0.46**

	Factor Loadings				
Item	1	2	3	4	5
Q25_53	0.05	**0.33**	-0.01	**0.37**	**0.75**
Q25_54	0.27	0.23	0.20	-0.05	**0.69**
Q25_55	-0.01	0.17	-0.15	**-0.37**	**0.85**
Q25_56	0.17	0.21	-0.00	**-0.51**	**0.65**
Q25_57	-0.15	0.06	0.01	**0.41**	**0.70**
Q25_58	-0.28	-0.06	-0.07	0.02	**0.78**
Q25_59	-0.01	-0.23	**0.42**	**-0.42**	**0.71**
Q25_60	-0.26	0.01	0.08	**0.51**	**0.94**
Q25_61	-0.19	-0.04	0.05	-0.04	**0.96**
Q25_62	0.14	-0.11	0.12	**-0.33**	**0.78**
Q25_63	**0.42**	0.01	**-0.34**	-0.01	**0.77**
Q25_64	**-0.59**	-0.03	-0.00	**0.48**	**0.55**
Q25_65	0.27	0.09	-0.08	0.02	**0.45**