A Comprehensive R-package for Studying Families, Based on the Social Relations Model

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1. The Social Relations Model (SRM)

1.1. Design and SRM components

Example

A family researcher is interested in fear of rejection within the family context (cfr. attachment) (Cook, 2000)

⇒ BUT is this a problem of an individual, a dyad or a family?

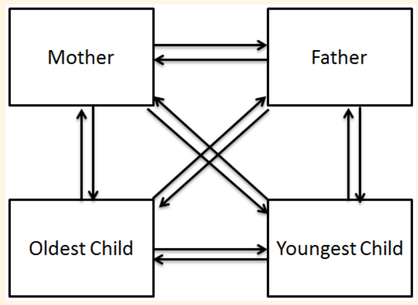
The SRM enables researchers to isolate and examine dynamics on these three different levels

Round Robin Design

- Each participating family member rates every other participating member
- At least three family members are required for the SRM
- In a four person family, this design results in 12 dyadic measurements

⇒ Variability across families on these dyadic measurements

⇒ SRM identifies sources of this variability



SRM components:

- Actor effect (for each role)
  - i.e. cross-relational consistency in the ratings of a particular person
  - e.g. a traumatized child may experience relationship anxiety towards all family members
- Partner effect (for each role)
  - i.e. cross-relational consistency of the ratings about one person
  - e.g. a cold and emotionally distant father may elicit fear of rejection
- Relationship effects
  - i.e. unique adaptation of one person towards another, controlled for both actor and partner effects
  - e.g. an extramarital affair causes that the wife experiences fear of rejection in relation to her husband
- Family effect
  - i.e. characteristics that causes all family members to be similar

1.2. Additional analyses

Additional analyses:

- Individual reciprocities
  - i.e. correlation between actor and partner effect
- Dyadic reciprocities
  - i.e. correlation between relationship effects
- Intragenerational similarities
  - i.e. correlation between actor or partner effects within same generation

1.3. Advantages

Some advantages of an SRM analysis:

- Examine family dynamics on three separate levels simultaneously (individual, dyadic and family level)
- Able to perform case studies, single and multigroup analyses
- Allows to investigate reciprocities
- Etiology of (extreme) dyadic measurements
- No more methodological artifacts: (e.g. labeling multiple unidirectional effects as bidirectionality)

1.4. Analyses

Each dyadic measure is viewed as a linear combination:

$$X_{ijk} = \mu_k + \alpha_{ik} + \beta_{jk} + \gamma_{ijk} + \epsilon_{ijk}$$

- μ_k = family effect
- α_{ik} = actor effect
- β_{jk} = partner effect
- γ_{ijk} = relationship effect
- ϵ_{ijk} = measurement error
- $_i$ = role of the rater
- $_j$ = role of the person being rated
- $_k$ = family ID

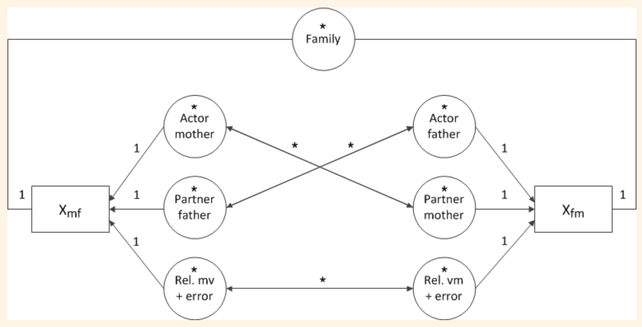


Figure: The SRM as a SEM

Boxes represent observed dyadic measurements, circles latent variables. Parameters that are fixed are indicated by '1', free parameters by an asterisk. Every indicator is connected with the corresponding latent variable by a single headed arrow. Double headed arrows represent reciprocities.

- SRM factors are specified as latent variables in a CFA
- Family researchers find it hard to perform analyses

⇒ SRM often not used due to complex analyses!

2. fSRM: A Comprehensive R-package for SRM analyses

2.1. Content

Different kinds of analyses are easily performed.

1. Information about the model fit (i.e. chi^2, CFI, TLI/NNFI, RMSEA)
2. Variance estimation
3. Relative variance decomposition
4. Estimation generalized reciprocities
5. Estimation dyadic reciprocities
6. Intragenerational similarities
7. Estimation mean SRM components

- Single or multiple group analyses
- Insert equality constraints
- Suitable for different family sizes
- Specify multiple dependent variables for dyadic measurements in order to separate relationship component from error variance
- Ask for modification indices and adjust model
- Manually add lavaan syntax

fSRM is built on lavaan (Rosseel, 2012), an R-package for structural equation modeling.

2.2. Example

```
> res <- fSRM(value ~ actor.id*partner.id | fam.id, data = data2,
              means = T, IGSIM=list(c("m","f"), c("c", "y")))
SRM with roles (latent) (Roles: c, f, m, y ; DVs =  value ) :
--------------------
Model summary:
---------------
lavaan (0.5-12) converged normally after 733 iterations

  Number of observations                           208

  Estimator                                         ML
  Minimum Function Test Statistic               43.088
  Degrees of freedom                                43
  P-value (Chi-square)                           0.468

1 Model Fit:
---------------
Chi2 (df=43) = 43.088, p = 0.468
CFI = 1
TLI / NNFI = 1
RMSEA = 0.003 [0;0.047]; Test of close fit: p(data | true value == .05) = 0.967

2 Variance decomposition:
---------------
                 f   est    se     z pvalue ci.lower ci.upper
1        FE ~~ FE 0.032 0.019 1.722  0.085   -0.004    0.069
2      A.c ~~ A.c 0.210 0.033 6.404  0.000    0.146    0.274
3      A.f ~~ A.f 0.233 0.037 6.348  0.000    0.161    0.304
4      A.m ~~ A.m 0.178 0.034 5.215  0.000    0.111    0.244
5      A.y ~~ A.y 0.225 0.038 5.906  0.000    0.150    0.300
6      P.c ~~ P.c 0.052 0.022 2.357  0.018    0.009    0.095
7      P.f ~~ P.f 0.069 0.024 2.832  0.005    0.021    0.117
8      P.m ~~ P.m 0.058 0.021 2.774  0.006    0.017    0.100
9      P.y ~~ P.y 0.068 0.023 2.970  0.003    0.023    0.112
10 R.c.f ~~ R.c.f 0.207 0.034 6.026  0.000    0.140    0.275
11 R.c.m ~~ R.c.m 0.107 0.026 4.111  0.000    0.056    0.158
12 R.c.y ~~ R.c.y 0.208 0.035 5.953  0.000    0.140    0.277
13 R.f.c ~~ R.f.c 0.168 0.033 5.062  0.000    0.103    0.233
14 R.f.m ~~ R.f.m 0.611 0.072 8.492  0.000    0.470    0.752
15 R.f.y ~~ R.f.y 0.203 0.036 5.651  0.000    0.132    0.273
16 R.m.c ~~ R.m.c 0.223 0.038 5.852  0.000    0.148    0.298
17 R.m.f ~~ R.m.f 0.480 0.062 7.738  0.000    0.359    0.602
18 R.m.y ~~ R.m.y 0.331 0.047 6.994  0.000    0.239    0.424
19 R.y.c ~~ R.y.c 0.350 0.050 7.062  0.000    0.253    0.447
20 R.y.f ~~ R.y.f 0.334 0.048 6.990  0.000    0.241    0.428
21 R.y.m ~~ R.y.m 0.201 0.036 5.541  0.000    0.130    0.273

3 Relative variance decomposition:
---------------
    Family Actor.Effect Partner.Effect Relationship.Effect Error explained
c_f      6           40             13                 40     0       100
c_m      8           52             14                 26     0       100
c_y      6           41             13                 40     0       100
f_c      7           48             11                 35     0       100
f_m      3           25              6                 65     0       100
f_y      6           43             13                 38     0       100
m_c      7           37             11                 46     0       100
m_f      4           23              9                 63     0       100
m_y      5           29             11                 54     0       100
y_c      5           34              8                 53     0       100
y_f      5           34             10                 51     0       100
y_m      6           44             11                 39     0       100
mean     6           38             11                 46     0       100

4 Generalized reciprocity (actor-partner covariances):
---------------
                 f   est    se     z pvalue ci.lower ci.upper    COR label
1  A.c ~~ P.c 0.069 0.021 3.349 0.001    0.029    0.109  0.663
2  A.f ~~ P.f -0.001 0.020 -0.063 0.949    -0.040    0.037 -0.010
3  A.m ~~ P.m 0.028 0.018 1.580 0.114    -0.007    0.063  0.277
4  A.y ~~ P.y 0.081 0.022 3.608 0.000    0.037    0.124  0.653

5 Dyadic reciprocity (relationship covariances): Mean r = 0.163 (out of bounds estimates set to NA)
---------------
                 f   est    se     z pvalue ci.lower ci.upper    COR label
1  R.c.f ~~ R.f.c  0.042 0.024  1.736  0.083   -0.005    0.089  0.223
2  R.c.m ~~ R.m.c  0.025 0.023  1.109  0.268   -0.019    0.069  0.162
3  R.c.y ~~ R.y.c  0.014 0.030  0.445  0.657   -0.046    0.073  0.050
4  R.f.m ~~ R.m.f  0.185 0.050  3.691  0.000    0.087    0.283  0.341
5  R.f.y ~~ R.y.f  0.051 0.030  1.712  0.087   -0.007    0.109  0.195
6  R.m.y ~~ R.y.m -0.002 0.029 -0.078  0.938   -0.060    0.055 -0.009

6 Intragenerational similarity:
---------------
                 f   est    se     z pvalue ci.lower ci.upper    COR   label
71 A.f ~~ A.m  0.026 0.026  0.988  0.323   -0.025    0.077  0.127 IGSIMA1
72 P.f ~~ P.m  0.020 0.017  1.191  0.234   -0.013    0.054  0.321 IGSIMP1
73 A.c ~~ A.y -0.006 0.027 -0.239  0.811   -0.058    0.046 -0.029 IGSIMA2
74 P.c ~~ P.y -0.019 0.018 -1.084  0.278   -0.054    0.015 -0.324 IGSIMP2

7 Mean structure
---------------
   factor    est    se      z pvalue ci.lower ci.upper
1      FE  1.838 0.027 67.705  0.000    1.785    1.892
2     A.c -0.134 0.034 -3.960  0.000   -0.200   -0.068
3     A.f  0.103 0.034  3.011  0.003    0.036    0.170
4     A.m -0.087 0.033 -2.653  0.008   -0.151   -0.023
5     A.y  0.117 0.036  3.307  0.001    0.048    0.187
6     P.c  0.022 0.026  0.835  0.404   -0.029    0.072
7     P.f  0.038 0.025  1.528  0.127   -0.011    0.086
8     P.m -0.169 0.024 -7.070  0.000   -0.215   -0.122
9     P.y  0.109 0.026  4.195  0.000    0.058    0.160
10 R.c.f -0.003 0.021 -0.142  0.887   -0.045    0.039
11 R.c.m -0.059 0.021 -2.861  0.004   -0.099   -0.018
12 R.c.y  0.062 0.023  2.630  0.009    0.016    0.108
13 R.f.c -0.066 0.022 -3.030  0.002   -0.109   -0.023
14 R.f.m  0.116 0.026  4.433  0.000    0.065    0.167
15 R.f.y -0.050 0.022 -2.262  0.024   -0.092   -0.007
16 R.m.c -0.028 0.023 -1.195  0.232   -0.073    0.018
17 R.m.f  0.040 0.026  1.547  0.122   -0.011    0.090
18 R.m.y -0.012 0.024 -0.512  0.608   -0.059    0.034
19 R.y.c  0.094 0.026  3.604  0.000    0.043    0.145
20 R.y.f -0.037 0.024 -1.541  0.123   -0.084    0.010
21 R.y.m -0.057 0.023 -2.509  0.012   -0.102   -0.013
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References

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