Personality change in college: Latent growth and stability models

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4/26/2021

Contents

Meta-data

```r
require(lavaan)
require(tidyverse)
require(semPlot)
set.seed(202102)
sessionInfo()
```

```
## R version 4.0.4 (2021-02-15)
## Platform: x86_64-w64-mingw32/x64 (64-bit)
## Running under: Windows 10 x64 (build 19041)
##
## Matrix products: default
##
## locale:
## [1] LC_COLLATE=English_United States.1252
## [2] LC_CTYPE=English_United States.1252
## [3] LC_MONETARY=English_United States.1252
## [4] LC_NUMERIC=C
## [5] LC_TIME=English_United States.1252
##
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base
##
## other attached packages:
## [1] semPlot_1.1.2   forcats_0.5.1   stringr_1.4.0   dplyr_1.0.4
```

```
## [5] purrr_0.3.4      readr_1.4.0      tidyr_1.1.2      tibble_3.0.6
## [9] ggplot2_3.3.3   tidyverse_1.3.0 lavaan_0.6-7
##
## loaded via a namespace (and not attached):
##   [1] minqa_1.2.4        colorspace_2.0-0   ellipsis_0.3.1
##   [4] htmlTable_2.1.0    corpcor_1.6.9      base64enc_0.1-3
##   [7] fs_1.5.0           rstudioapi_0.13    lubridate_1.7.9.2
##  [10] xml2_1.3.2         splines_4.0.4      mnormt_2.0.2
##  [13] knitr_1.31         glasso_1.11        Formula_1.2-4
##  [16] jsonlite_1.7.2     nloptr_1.2.2.2     broom_0.7.5
##  [19] cluster_2.1.0      dbplyr_2.1.0       png_0.1-7
##  [22] regsem_1.6.2       compiler_4.0.4     httr_1.4.2
##  [25] backports_1.2.1    assertthat_0.2.1   Matrix_1.3-2
##  [28] cli_2.3.0          htmltools_0.5.1.1  tools_4.0.4
##  [31] OpenMx_2.18.1      igraph_1.2.6       coda_0.19-4
##  [34] gtable_0.3.0       glue_1.4.2         reshape2_1.4.4
##  [37] Rcpp_1.0.6         carData_3.0-4      cellranger_1.1.0
##  [40] vctrs_0.3.6        nlme_3.1-152       lisrelToR_0.1.4
##  [43] psych_2.0.12       xfun_0.21          openxlsx_4.2.3
##  [46] lme4_1.1-26        rvest_0.3.6        lifecycle_1.0.0
##  [49] gtools_3.8.2       XML_3.99-0.5       statmod_1.4.35
##  [52] MASS_7.3-53        scales_1.1.1       hms_1.0.0
##  [55] kutils_1.70        parallel_4.0.4     RColorBrewer_1.1-2
##  [58] yaml_2.2.1         pbapply_1.4-3      gridExtra_2.3
##  [61] rpart_4.1-15       latticeExtra_0.6-29 stringi_1.5.3
##  [64] sem_3.1-11         checkmate_2.0.0    boot_1.3-27
##  [67] zip_2.1.1          truncnorm_1.0-8    rlang_0.4.10
##  [70] pkgconfig_2.0.3    Rsolnp_1.16        arm_1.11-2
##  [73] evaluate_0.14      lattice_0.20-41    htmlwidgets_1.5.3
##  [76] tidyselect_1.1.0   plyr_1.8.6         magrittr_2.0.1
##  [79] R6_2.5.0           generics_0.1.0     Hmisc_4.4-2
##  [82] DBI_1.1.1          pillar_1.4.7       haven_2.3.1
##  [85] foreign_0.8-81     withr_2.4.1        rockchalk_1.8.144
##  [88] survival_3.2-7     abind_1.4-5        nnet_7.3-15
##  [91] modelr_0.1.8       crayon_1.4.1       fdrtool_1.2.16
##  [94] tmvnsim_1.0-2      rmarkdown_2.7      jpeg_0.1-8.1
##  [97] qgraph_1.6.9       grid_4.0.4         readxl_1.3.1
## [100] data.table_1.14.0  pbivnorm_0.6.0     matrixcalc_1.0-3
## [103] reprex_1.0.0       digest_0.6.27      xtable_1.8-4
## [106] mi_1.0             stats4_4.0.4       munsell_0.5.0
```

Preprocessing

Data

```r
data <- read.csv(file = "lavaanData.csv", na.strings = "-999", header = F)
colnames(data) <- c(#self reports:
                    paste0("w1bf_", 1:100),
                    paste0("w1epsi_", 1:12),
                    paste0("w2bf_", 1:100),
                    paste0("w2epsi_", 1:12),
                    paste0("w3bf_", 1:100),
                    paste0("w3epsi_", 1:12),
```

```
                    paste0("w4bf_", 1:100),
                    paste0("w4epsi_", 1:12),
                    #peer reports:
                    paste0("pw1bf_", 1:100),
                    paste0("pw1epsi_", 1:12),
                    paste0("pw2bf_", 1:100),
                    paste0("pw2epsi_", 1:12),
                    paste0("pw3bf_", 1:100),
                    paste0("pw3epsi_", 1:12),
                    paste0("pw4bf_", 1:100),
                    paste0("pw4epsi_", 1:12))
```

Parcels

```r
# self aspect randomization - 0, 4, 6, 7, 8 vs. 1, 2, 3, 5, 9
sample(c(0,1,2,3,4,5,6,7,8,9), 5)
```

```
## [1] 4 6 0 7 8
```

```r
# peer aspect randomization - 1, 2, 4, 5, 6 vs. 0, 3, 7, 8, 9
sample(c(0,1,2,3,4,5,6,7,8,9), 5)
```

```
## [1] 2 5 1 4 6
```

```r
# self domain randomization - 1,3,4,6,7,9,10,30,40,90 vs. 0,2,5,8,00,20,50,60,70,80
sample(c(0,1,2,3,4,5,6,7,8,9,
         00,10,20,30,40,50,60,70,80,90), 10)
```

```
##  [1]  9  4  3 30  1 10 40  7 90  6
```

```r
# peer domain randomization - 0,2,3,4,8,10,30,40,50,80 vs. 1,5,6,7,9,00,20,60,70,90
sample(c(0,1,2,3,4,5,6,7,8,9,
         00,10,20,30,40,50,60,70,80,90), 10)
```

```
##  [1] 30 50  2  0  3 80 10  8 40  4
```

```r
# self identity randomization
sample(c(1,3,7,10,11,12), 3) #confusion - 7,10,11 vs. 1,3,12
```

```
## [1]  7 11 10
```

```r
sample(c(2,4,5,6,8,9), 3) #coherence - 2,5,6 vs. 4,8,9
```

```
## [1] 5 2 6
```

```r
# peer identity randomization
sample(c(1,3,7,10,11,12), 3) #confusion - 3,7,12 vs. 1,10,11
```

```
## [1]  3  7 12
```

```r
sample(c(2,4,5,6,8,9), 3) #coherence - 4,5,9 vs. 2,6,8
```

```
## [1] 4 9 5
```

```r
# >>> Aspects ----

# assertiveness
data <- data %>%
  mutate(# self
```

```r
        assertW1S = rowMeans(select(data, w1bf_9, w1bf_19, w1bf_29, w1bf_39, w1bf_49, w1bf_59,
                                    w1bf_69, w1bf_79, w1bf_89, w1bf_99), na.rm = T),
        assertW2S = rowMeans(select(data, w2bf_9, w2bf_19, w2bf_29, w2bf_39, w2bf_49, w2bf_59,
                                    w2bf_69, w2bf_79, w2bf_89, w2bf_99), na.rm = T),
        assertW3S = rowMeans(select(data, w3bf_9, w3bf_19, w3bf_29, w3bf_39, w3bf_49, w3bf_59,
                                    w3bf_69, w3bf_79, w3bf_89, w3bf_99), na.rm = T),
        assertW4S = rowMeans(select(data, w4bf_9, w4bf_19, w4bf_29, w4bf_39, w4bf_49, w4bf_59,
                                    w4bf_69, w4bf_79, w4bf_89, w4bf_99), na.rm = T),

        # peer
        assertW1P = rowMeans(select(data, pw1bf_9, pw1bf_19, pw1bf_29, pw1bf_39, pw1bf_49, pw1bf_59,
                                    pw1bf_69, pw1bf_79, pw1bf_89, pw1bf_99), na.rm = T),
        assertW2P = rowMeans(select(data, pw2bf_9, pw2bf_19, pw2bf_29, pw2bf_39, pw2bf_49, pw2bf_59,
                                    pw2bf_69, pw2bf_79, pw2bf_89, pw2bf_99), na.rm = T),
        assertW3P = rowMeans(select(data, pw3bf_9, pw3bf_19, pw3bf_29, pw3bf_39, pw3bf_49, pw3bf_59,
                                    pw3bf_69, pw3bf_79, pw3bf_89, pw3bf_99), na.rm = T),
        assertW4P = rowMeans(select(data, pw4bf_9, pw4bf_19, pw4bf_29, pw4bf_39, pw4bf_49, pw4bf_59,
                                    pw4bf_69, pw4bf_79, pw4bf_89, pw4bf_99), na.rm = T))

data <- data %>%
  mutate(# first self parcel
        assertW1S1 = rowMeans(select(data, w1bf_9, w1bf_49, w1bf_69, w1bf_79, w1bf_89),na.rm = T),
        assertW2S1 = rowMeans(select(data, w2bf_9, w2bf_49, w2bf_69, w2bf_79, w2bf_89),na.rm = T),
        assertW3S1 = rowMeans(select(data, w3bf_9, w3bf_49, w3bf_69, w3bf_79, w3bf_89),na.rm = T),
        assertW4S1 = rowMeans(select(data, w4bf_9, w4bf_49, w4bf_69, w4bf_79, w4bf_89),na.rm = T),

        # second self parcel
        assertW1S2 = rowMeans(select(data, w1bf_19, w1bf_29, w1bf_39, w1bf_59, w1bf_99),na.rm = T),
        assertW2S2 = rowMeans(select(data, w2bf_19, w2bf_29, w2bf_39, w2bf_59, w2bf_99),na.rm = T),
        assertW3S2 = rowMeans(select(data, w3bf_19, w3bf_29, w3bf_39, w3bf_59, w3bf_99),na.rm = T),
        assertW4S2 = rowMeans(select(data, w4bf_19, w4bf_29, w4bf_39, w4bf_59, w4bf_99),na.rm = T),

        # first peer parcel
        assertW1P1 = rowMeans(select(data, pw1bf_19, pw1bf_29, pw1bf_49, pw1bf_59, pw1bf_69), na.rm = T
        assertW2P1 = rowMeans(select(data, pw2bf_19, pw2bf_29, pw2bf_49, pw2bf_59, pw2bf_69), na.rm = T
        assertW3P1 = rowMeans(select(data, pw3bf_19, pw3bf_29, pw3bf_49, pw3bf_59, pw3bf_69), na.rm = T
        assertW4P1 = rowMeans(select(data, pw4bf_19, pw4bf_29, pw4bf_49, pw4bf_59, pw4bf_69), na.rm = T

        # second peer parcel
        assertW1P2 = rowMeans(select(data, pw1bf_9, pw1bf_39, pw1bf_79, pw1bf_89, pw1bf_99), na.rm = T
        assertW2P2 = rowMeans(select(data, pw2bf_9, pw2bf_39, pw2bf_79, pw2bf_89, pw2bf_99), na.rm = T
        assertW3P2 = rowMeans(select(data, pw3bf_9, pw3bf_39, pw3bf_79, pw3bf_89, pw3bf_99), na.rm = T
        assertW4P2 = rowMeans(select(data, pw4bf_9, pw4bf_39, pw4bf_79, pw4bf_89, pw4bf_99), na.rm = T

# compassion
data <- data %>%
  mutate(# self
        compaW1S = rowMeans(select(data, w1bf_2, w1bf_12, w1bf_22, w1bf_32, w1bf_42, w1bf_52,
                                   w1bf_62, w1bf_72, w1bf_82, w1bf_92), na.rm = T),
        compaW2S = rowMeans(select(data, w2bf_2, w2bf_12, w2bf_22, w2bf_32, w2bf_42, w2bf_52,
                                   w2bf_62, w2bf_72, w2bf_82, w2bf_92), na.rm = T),
        compaW3S = rowMeans(select(data, w3bf_2, w3bf_12, w3bf_22, w3bf_32, w3bf_42, w3bf_52,
                                   w3bf_62, w3bf_72, w3bf_82, w3bf_92), na.rm = T),
```

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        compaW4S = rowMeans(select(data, w4bf_2, w4bf_12, w4bf_22, w4bf_32, w4bf_42, w4bf_52,
                                   w4bf_62, w4bf_72, w4bf_82, w4bf_92), na.rm = T),

        # peer
        compaW1P = rowMeans(select(data, pw1bf_2, pw1bf_12, pw1bf_22, pw1bf_32, pw1bf_42, pw1bf_52,
                                   pw1bf_62, pw1bf_72, pw1bf_82, pw1bf_92), na.rm = T),
        compaW2P = rowMeans(select(data, pw2bf_2, pw2bf_12, pw2bf_22, pw2bf_32, pw2bf_42, pw2bf_52,
                                   pw2bf_62, pw2bf_72, pw2bf_82, pw2bf_92), na.rm = T),
        compaW3P = rowMeans(select(data, pw3bf_2, pw3bf_12, pw3bf_22, pw3bf_32, pw3bf_42, pw3bf_52,
                                   pw3bf_62, pw3bf_72, pw3bf_82, pw3bf_92), na.rm = T),
        compaW4P = rowMeans(select(data, pw4bf_2, pw4bf_12, pw4bf_22, pw4bf_32, pw4bf_42, pw4bf_52,
                                   pw4bf_62, pw4bf_72, pw4bf_82, pw4bf_92), na.rm = T))

data <- data %>%
  mutate(# first self parcel
        compaW1S1 = rowMeans(select(data, w1bf_2, w1bf_42, w1bf_62, w1bf_72, w1bf_82),na.rm = T),
        compaW2S1 = rowMeans(select(data, w2bf_2, w2bf_42, w2bf_62, w2bf_72, w2bf_82),na.rm = T),
        compaW3S1 = rowMeans(select(data, w3bf_2, w3bf_42, w3bf_62, w3bf_72, w3bf_82),na.rm = T),
        compaW4S1 = rowMeans(select(data, w4bf_2, w4bf_42, w4bf_62, w4bf_72, w4bf_82),na.rm = T),

        # second self parcel
        compaW1S2 = rowMeans(select(data, w1bf_12, w1bf_22, w1bf_32, w1bf_52, w1bf_92),na.rm = T),
        compaW2S2 = rowMeans(select(data, w2bf_12, w2bf_22, w2bf_32, w2bf_52, w2bf_92),na.rm = T),
        compaW3S2 = rowMeans(select(data, w3bf_12, w3bf_22, w3bf_32, w3bf_52, w3bf_92),na.rm = T),
        compaW4S2 = rowMeans(select(data, w4bf_12, w4bf_22, w4bf_32, w4bf_52, w4bf_92),na.rm = T),

        # first peer parcel
        compaW1P1 = rowMeans(select(data, pw1bf_12, pw1bf_22, pw1bf_42, pw1bf_52, pw1bf_62), na.rm = T]
        compaW2P1 = rowMeans(select(data, pw2bf_12, pw2bf_22, pw2bf_42, pw2bf_52, pw2bf_62), na.rm = T]
        compaW3P1 = rowMeans(select(data, pw3bf_12, pw3bf_22, pw3bf_42, pw3bf_52, pw3bf_62), na.rm = T]
        compaW4P1 = rowMeans(select(data, pw4bf_12, pw4bf_22, pw4bf_42, pw4bf_52, pw4bf_62), na.rm = T]

        # second peer parcel
        compaW1P2 = rowMeans(select(data, pw1bf_2, pw1bf_32, pw1bf_72, pw1bf_82, pw1bf_92), na.rm = T)
        compaW2P2 = rowMeans(select(data, pw2bf_2, pw2bf_32, pw2bf_72, pw2bf_82, pw2bf_92), na.rm = T)
        compaW3P2 = rowMeans(select(data, pw3bf_2, pw3bf_32, pw3bf_72, pw3bf_82, pw3bf_92), na.rm = T)
        compaW4P2 = rowMeans(select(data, pw4bf_2, pw4bf_32, pw4bf_72, pw4bf_82, pw4bf_92), na.rm = T))

# enthusiasm
data <- data %>%
  mutate(# self
        enthuW1S = rowMeans(select(data, w1bf_4, w1bf_14, w1bf_24, w1bf_34, w1bf_44, w1bf_54,
                                   w1bf_64, w1bf_74, w1bf_84, w1bf_94), na.rm = T),
        enthuW2S = rowMeans(select(data, w2bf_4, w2bf_14, w2bf_24, w2bf_34, w2bf_44, w2bf_54,
                                   w2bf_64, w2bf_74, w2bf_84, w2bf_94), na.rm = T),
        enthuW3S = rowMeans(select(data, w3bf_4, w3bf_14, w3bf_24, w3bf_34, w3bf_44, w3bf_54,
                                   w3bf_64, w3bf_74, w3bf_84, w3bf_94), na.rm = T),
        enthuW4S = rowMeans(select(data, w4bf_4, w4bf_14, w4bf_24, w4bf_34, w4bf_44, w4bf_54,
                                   w4bf_64, w4bf_74, w4bf_84, w4bf_94), na.rm = T),

        # peer
        enthuW1P = rowMeans(select(data, pw1bf_4, pw1bf_14, pw1bf_24, pw1bf_34, pw1bf_44, pw1bf_54,
                                   pw1bf_64, pw1bf_74, pw1bf_84, pw1bf_94), na.rm = T),
```

```r
        enthuW2P = rowMeans(select(data, pw2bf_4, pw2bf_14, pw2bf_24, pw2bf_34, pw2bf_44, pw2bf_54,
                              pw2bf_64, pw2bf_74, pw2bf_84, pw2bf_94), na.rm = T),
        enthuW3P = rowMeans(select(data, pw3bf_4, pw3bf_14, pw3bf_24, pw3bf_34, pw3bf_44, pw3bf_54,
                              pw3bf_64, pw3bf_74, pw3bf_84, pw3bf_94), na.rm = T),
        enthuW4P = rowMeans(select(data, pw4bf_4, pw4bf_14, pw4bf_24, pw4bf_34, pw4bf_44, pw4bf_54,
                              pw4bf_64, pw4bf_74, pw4bf_84, pw4bf_94), na.rm = T))

data <- data %>%
  mutate(# first self parcel
        enthuW1S1 = rowMeans(select(data, w1bf_4, w1bf_44, w1bf_64, w1bf_74, w1bf_84),na.rm = T),
        enthuW2S1 = rowMeans(select(data, w2bf_4, w2bf_44, w2bf_64, w2bf_74, w2bf_84),na.rm = T),
        enthuW3S1 = rowMeans(select(data, w3bf_4, w3bf_44, w3bf_64, w3bf_74, w3bf_84),na.rm = T),
        enthuW4S1 = rowMeans(select(data, w4bf_4, w4bf_44, w4bf_64, w4bf_74, w4bf_84),na.rm = T),

        # second self parcel
        enthuW1S2 = rowMeans(select(data, w1bf_14, w1bf_24, w1bf_34, w1bf_54, w1bf_94),na.rm = T),
        enthuW2S2 = rowMeans(select(data, w2bf_14, w2bf_24, w2bf_34, w2bf_54, w2bf_94),na.rm = T),
        enthuW3S2 = rowMeans(select(data, w3bf_14, w3bf_24, w3bf_34, w3bf_54, w3bf_94),na.rm = T),
        enthuW4S2 = rowMeans(select(data, w4bf_14, w4bf_24, w4bf_34, w4bf_54, w4bf_94),na.rm = T),

        # first peer parcel
        enthuW1P1 = rowMeans(select(data, pw1bf_14, pw1bf_24, pw1bf_44, pw1bf_54, pw1bf_64), na.rm = T],
        enthuW2P1 = rowMeans(select(data, pw2bf_14, pw2bf_24, pw2bf_44, pw2bf_54, pw2bf_64), na.rm = T],
        enthuW3P1 = rowMeans(select(data, pw3bf_14, pw3bf_24, pw3bf_44, pw3bf_54, pw3bf_64), na.rm = T],
        enthuW4P1 = rowMeans(select(data, pw4bf_14, pw4bf_24, pw4bf_44, pw4bf_54, pw4bf_64), na.rm = T],

        # second peer parcel
        enthuW1P2 = rowMeans(select(data, pw1bf_4, pw1bf_34, pw1bf_74, pw1bf_84, pw1bf_94), na.rm = T)
        enthuW2P2 = rowMeans(select(data, pw2bf_4, pw2bf_34, pw2bf_74, pw2bf_84, pw2bf_94), na.rm = T)
        enthuW3P2 = rowMeans(select(data, pw3bf_4, pw3bf_34, pw3bf_74, pw3bf_84, pw3bf_94), na.rm = T)
        enthuW4P2 = rowMeans(select(data, pw4bf_4, pw4bf_34, pw4bf_74, pw4bf_84, pw4bf_94), na.rm = T))

# industriousness
data <- data %>%
  mutate(# self
        indusW1S = rowMeans(select(data, w1bf_3, w1bf_13, w1bf_23, w1bf_33, w1bf_43, w1bf_53,
                                w1bf_63, w1bf_73, w1bf_83, w1bf_93), na.rm = T),
        indusW2S = rowMeans(select(data, w2bf_3, w2bf_13, w2bf_23, w2bf_33, w2bf_43, w2bf_53,
                                w2bf_63, w2bf_73, w2bf_83, w2bf_93), na.rm = T),
        indusW3S = rowMeans(select(data, w3bf_3, w3bf_13, w3bf_23, w3bf_33, w3bf_43, w3bf_53,
                                w3bf_63, w3bf_73, w3bf_83, w3bf_93), na.rm = T),
        indusW4S = rowMeans(select(data, w4bf_3, w4bf_13, w4bf_23, w4bf_33, w4bf_43, w4bf_53,
                                w4bf_63, w4bf_73, w4bf_83, w4bf_93), na.rm = T),

        # peer
        indusW1P = rowMeans(select(data, pw1bf_3, pw1bf_13, pw1bf_23, pw1bf_33, pw1bf_43, pw1bf_53,
                                pw1bf_63, pw1bf_73, pw1bf_83, pw1bf_93), na.rm = T),
        indusW2P = rowMeans(select(data, pw2bf_3, pw2bf_13, pw2bf_23, pw2bf_33, pw2bf_43, pw2bf_53,
                                pw2bf_63, pw2bf_73, pw2bf_83, pw2bf_93), na.rm = T),
        indusW3P = rowMeans(select(data, pw3bf_3, pw3bf_13, pw3bf_23, pw3bf_33, pw3bf_43, pw3bf_53,
                                pw3bf_63, pw3bf_73, pw3bf_83, pw3bf_93), na.rm = T),
        indusW4P = rowMeans(select(data, pw4bf_3, pw4bf_13, pw4bf_23, pw4bf_33, pw4bf_43, pw4bf_53,
                                pw4bf_63, pw4bf_73, pw4bf_83, pw4bf_93), na.rm = T))
```

```r
data <- data %>%
  mutate(# first self parcel
         indusW1S1 = rowMeans(select(data, w1bf_3, w1bf_43, w1bf_63, w1bf_73, w1bf_83),na.rm = T),
         indusW2S1 = rowMeans(select(data, w2bf_3, w2bf_43, w2bf_63, w2bf_73, w2bf_83),na.rm = T),
         indusW3S1 = rowMeans(select(data, w3bf_3, w3bf_43, w3bf_63, w3bf_73, w3bf_83),na.rm = T),
         indusW4S1 = rowMeans(select(data, w4bf_3, w4bf_43, w4bf_63, w4bf_73, w4bf_83),na.rm = T),

         # second self parcel
         indusW1S2 = rowMeans(select(data, w1bf_13, w1bf_23, w1bf_33, w1bf_53, w1bf_93),na.rm = T),
         indusW2S2 = rowMeans(select(data, w2bf_13, w2bf_23, w2bf_33, w2bf_53, w2bf_93),na.rm = T),
         indusW3S2 = rowMeans(select(data, w3bf_13, w3bf_23, w3bf_33, w3bf_53, w3bf_93),na.rm = T),
         indusW4S2 = rowMeans(select(data, w4bf_13, w4bf_23, w4bf_33, w4bf_53, w4bf_93),na.rm = T),

         # first peer parcel
         indusW1P1 = rowMeans(select(data, pw1bf_13, pw1bf_23, pw1bf_43, pw1bf_53, pw1bf_63), na.rm = T
         indusW2P1 = rowMeans(select(data, pw2bf_13, pw2bf_23, pw2bf_43, pw2bf_53, pw2bf_63), na.rm = T
         indusW3P1 = rowMeans(select(data, pw3bf_13, pw3bf_23, pw3bf_43, pw3bf_53, pw3bf_63), na.rm = T
         indusW4P1 = rowMeans(select(data, pw4bf_13, pw4bf_23, pw4bf_43, pw4bf_53, pw4bf_63), na.rm = T

         # second peer parcel
         indusW1P2 = rowMeans(select(data, pw1bf_3, pw1bf_33, pw1bf_73, pw1bf_83, pw1bf_93), na.rm = T)
         indusW2P2 = rowMeans(select(data, pw2bf_3, pw2bf_33, pw2bf_73, pw2bf_83, pw2bf_93), na.rm = T)
         indusW3P2 = rowMeans(select(data, pw3bf_3, pw3bf_33, pw3bf_73, pw3bf_83, pw3bf_93), na.rm = T)
         indusW4P2 = rowMeans(select(data, pw4bf_3, pw4bf_33, pw4bf_73, pw4bf_83, pw4bf_93), na.rm = T)

# intellect
data <- data %>%
  mutate(# self
         intelW1S = rowMeans(select(data, w1bf_5, w1bf_15, w1bf_25, w1bf_35, w1bf_45, w1bf_55,
                                    w1bf_65, w1bf_75, w1bf_85, w1bf_95), na.rm = T),
         intelW2S = rowMeans(select(data, w2bf_5, w2bf_15, w2bf_25, w2bf_35, w2bf_45, w2bf_55,
                                    w2bf_65, w2bf_75, w2bf_85, w2bf_95), na.rm = T),
         intelW3S = rowMeans(select(data, w3bf_5, w3bf_15, w3bf_25, w3bf_35, w3bf_45, w3bf_55,
                                    w3bf_65, w3bf_75, w3bf_85, w3bf_95), na.rm = T),
         intelW4S = rowMeans(select(data, w4bf_5, w4bf_15, w4bf_25, w4bf_35, w4bf_45, w4bf_55,
                                    w4bf_65, w4bf_75, w4bf_85, w4bf_95), na.rm = T),

         # peer
         intelW1P = rowMeans(select(data, pw1bf_5, pw1bf_15, pw1bf_25, pw1bf_35, pw1bf_45, pw1bf_55,
                                    pw1bf_65, pw1bf_75, pw1bf_85, pw1bf_95), na.rm = T),
         intelW2P = rowMeans(select(data, pw2bf_5, pw2bf_15, pw2bf_25, pw2bf_35, pw2bf_45, pw2bf_55,
                                    pw2bf_65, pw2bf_75, pw2bf_85, pw2bf_95), na.rm = T),
         intelW3P = rowMeans(select(data, pw3bf_5, pw3bf_15, pw3bf_25, pw3bf_35, pw3bf_45, pw3bf_55,
                                    pw3bf_65, pw3bf_75, pw3bf_85, pw3bf_95), na.rm = T),
         intelW4P = rowMeans(select(data, pw4bf_5, pw4bf_15, pw4bf_25, pw4bf_35, pw4bf_45, pw4bf_55,
                                    pw4bf_65, pw4bf_75, pw4bf_85, pw4bf_95), na.rm = T))

data <- data %>%
  mutate(# first self parcel
         intelW1S1 = rowMeans(select(data, w1bf_5, w1bf_45, w1bf_65, w1bf_75, w1bf_85),na.rm = T),
         intelW2S1 = rowMeans(select(data, w2bf_5, w2bf_45, w2bf_65, w2bf_75, w2bf_85),na.rm = T),
         intelW3S1 = rowMeans(select(data, w3bf_5, w3bf_45, w3bf_65, w3bf_75, w3bf_85),na.rm = T),
         intelW4S1 = rowMeans(select(data, w4bf_5, w4bf_45, w4bf_65, w4bf_75, w4bf_85),na.rm = T),
```

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        # second self parcel
        intelW1S2 = rowMeans(select(data, w1bf_15, w1bf_25, w1bf_35, w1bf_55, w1bf_95),na.rm = T),
        intelW2S2 = rowMeans(select(data, w2bf_15, w2bf_25, w2bf_35, w2bf_55, w2bf_95),na.rm = T),
        intelW3S2 = rowMeans(select(data, w3bf_15, w3bf_25, w3bf_35, w3bf_55, w3bf_95),na.rm = T),
        intelW4S2 = rowMeans(select(data, w4bf_15, w4bf_25, w4bf_35, w4bf_55, w4bf_95),na.rm = T),

        # first peer parcel
        intelW1P1 = rowMeans(select(data, pw1bf_15, pw1bf_25, pw1bf_45, pw1bf_55, pw1bf_65), na.rm = T),
        intelW2P1 = rowMeans(select(data, pw2bf_15, pw2bf_25, pw2bf_45, pw2bf_55, pw2bf_65), na.rm = T),
        intelW3P1 = rowMeans(select(data, pw3bf_15, pw3bf_25, pw3bf_45, pw3bf_55, pw3bf_65), na.rm = T),
        intelW4P1 = rowMeans(select(data, pw4bf_15, pw4bf_25, pw4bf_45, pw4bf_55, pw4bf_65), na.rm = T),

        # second peer parcel
        intelW1P2 = rowMeans(select(data, pw1bf_5, pw1bf_35, pw1bf_75, pw1bf_85, pw1bf_95), na.rm = T),
        intelW2P2 = rowMeans(select(data, pw2bf_5, pw2bf_35, pw2bf_75, pw2bf_85, pw2bf_95), na.rm = T),
        intelW3P2 = rowMeans(select(data, pw3bf_5, pw3bf_35, pw3bf_75, pw3bf_85, pw3bf_95), na.rm = T),
        intelW4P2 = rowMeans(select(data, pw4bf_5, pw4bf_35, pw4bf_75, pw4bf_85, pw4bf_95), na.rm = T))

# openness aspect
data <- data %>%
  mutate(# self
        openaW1S = rowMeans(select(data, w1bf_100, w1bf_10, w1bf_20, w1bf_30, w1bf_40, w1bf_50,
                                   w1bf_60, w1bf_70, w1bf_80, w1bf_90), na.rm = T),
        openaW2S = rowMeans(select(data, w2bf_100, w2bf_10, w2bf_20, w2bf_30, w2bf_40, w2bf_50,
                                   w2bf_60, w2bf_70, w2bf_80, w2bf_90), na.rm = T),
        openaW3S = rowMeans(select(data, w3bf_100, w3bf_10, w3bf_20, w3bf_30, w3bf_40, w3bf_50,
                                   w3bf_60, w3bf_70, w3bf_80, w3bf_90), na.rm = T),
        openaW4S = rowMeans(select(data, w4bf_100, w4bf_10, w4bf_20, w4bf_30, w4bf_40, w4bf_50,
                                   w4bf_60, w4bf_70, w4bf_80, w4bf_90), na.rm = T),

        # peer
        openaW1P = rowMeans(select(data, pw1bf_100, pw1bf_10, pw1bf_20, pw1bf_30, pw1bf_40, pw1bf_50,
                                   pw1bf_60, pw1bf_70, pw1bf_80, pw1bf_90), na.rm = T),
        openaW2P = rowMeans(select(data, pw2bf_100, pw2bf_10, pw2bf_20, pw2bf_30, pw2bf_40, pw2bf_50,
                                   pw2bf_60, pw2bf_70, pw2bf_80, pw2bf_90), na.rm = T),
        openaW3P = rowMeans(select(data, pw3bf_100, pw3bf_10, pw3bf_20, pw3bf_30, pw3bf_40, pw3bf_50,
                                   pw3bf_60, pw3bf_70, pw3bf_80, pw3bf_90), na.rm = T),
        openaW4P = rowMeans(select(data, pw4bf_100, pw4bf_10, pw4bf_20, pw4bf_30, pw4bf_40, pw4bf_50,
                                   pw4bf_60, pw4bf_70, pw4bf_80, pw4bf_90), na.rm = T))

data <- data %>%
  mutate(# first self parcel
        openaW1S1 = rowMeans(select(data, w1bf_100, w1bf_40, w1bf_60, w1bf_70, w1bf_84),na.rm = T),
        openaW2S1 = rowMeans(select(data, w2bf_100, w2bf_40, w2bf_60, w2bf_70, w2bf_84),na.rm = T),
        openaW3S1 = rowMeans(select(data, w3bf_100, w3bf_40, w3bf_60, w3bf_70, w3bf_84),na.rm = T),
        openaW4S1 = rowMeans(select(data, w4bf_100, w4bf_40, w4bf_60, w4bf_70, w4bf_84),na.rm = T),

        # second self parcel
        openaW1S2 = rowMeans(select(data, w1bf_10, w1bf_20, w1bf_30, w1bf_50, w1bf_94),na.rm = T),
        openaW2S2 = rowMeans(select(data, w2bf_10, w2bf_20, w2bf_30, w2bf_50, w2bf_94),na.rm = T),
        openaW3S2 = rowMeans(select(data, w3bf_10, w3bf_20, w3bf_30, w3bf_50, w3bf_94),na.rm = T),
        openaW4S2 = rowMeans(select(data, w4bf_10, w4bf_20, w4bf_30, w4bf_50, w4bf_94),na.rm = T),
```

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          # first peer parcel
          openaW1P1 = rowMeans(select(data, pw1bf_10, pw1bf_20, pw1bf_40, pw1bf_50, pw1bf_64), na.rm = T
          openaW2P1 = rowMeans(select(data, pw2bf_10, pw2bf_20, pw2bf_40, pw2bf_50, pw2bf_64), na.rm = T
          openaW3P1 = rowMeans(select(data, pw3bf_10, pw3bf_20, pw3bf_40, pw3bf_50, pw3bf_64), na.rm = T
          openaW4P1 = rowMeans(select(data, pw4bf_10, pw4bf_20, pw4bf_40, pw4bf_50, pw4bf_64), na.rm = T

          # second peer parcel
          openaW1P2 = rowMeans(select(data, pw1bf_100, pw1bf_30, pw1bf_70, pw1bf_80, pw1bf_94), na.rm =
          openaW2P2 = rowMeans(select(data, pw2bf_100, pw2bf_30, pw2bf_70, pw2bf_80, pw2bf_94), na.rm =
          openaW3P2 = rowMeans(select(data, pw3bf_100, pw3bf_30, pw3bf_70, pw3bf_80, pw3bf_94), na.rm =
          openaW4P2 = rowMeans(select(data, pw4bf_100, pw4bf_30, pw4bf_70, pw4bf_80, pw4bf_94), na.rm =

# orderliness
data <- data %>%
  mutate(# self
          orderW1S = rowMeans(select(data, w1bf_8, w1bf_18, w1bf_28, w1bf_38, w1bf_48, w1bf_58,
                                     w1bf_68, w1bf_78, w1bf_88, w1bf_98), na.rm = T),
          orderW2S = rowMeans(select(data, w2bf_8, w2bf_18, w2bf_28, w2bf_38, w2bf_48, w2bf_58,
                                     w2bf_68, w2bf_78, w2bf_88, w2bf_98), na.rm = T),
          orderW3S = rowMeans(select(data, w3bf_8, w3bf_18, w3bf_28, w3bf_38, w3bf_48, w3bf_58,
                                     w3bf_68, w3bf_78, w3bf_88, w3bf_98), na.rm = T),
          orderW4S = rowMeans(select(data, w4bf_8, w4bf_18, w4bf_28, w4bf_38, w4bf_48, w4bf_58,
                                     w4bf_68, w4bf_78, w4bf_88, w4bf_98), na.rm = T),

          # peer
          orderW1P = rowMeans(select(data, pw1bf_8, pw1bf_18, pw1bf_28, pw1bf_38, pw1bf_48, pw1bf_58,
                                     pw1bf_68, pw1bf_78, pw1bf_88, pw1bf_98), na.rm = T),
          orderW2P = rowMeans(select(data, pw2bf_8, pw2bf_18, pw2bf_28, pw2bf_38, pw2bf_48, pw2bf_58,
                                     pw2bf_68, pw2bf_78, pw2bf_88, pw2bf_98), na.rm = T),
          orderW3P = rowMeans(select(data, pw3bf_8, pw3bf_18, pw3bf_28, pw3bf_38, pw3bf_48, pw3bf_58,
                                     pw3bf_68, pw3bf_78, pw3bf_88, pw3bf_98), na.rm = T),
          orderW4P = rowMeans(select(data, pw4bf_8, pw4bf_18, pw4bf_28, pw4bf_38, pw4bf_48, pw4bf_58,
                                     pw4bf_68, pw4bf_78, pw4bf_88, pw4bf_98), na.rm = T))

data <- data %>%
  mutate(# first self parcel
          orderW1S1 = rowMeans(select(data, w1bf_8, w1bf_48, w1bf_68, w1bf_78, w1bf_88),na.rm = T),
          orderW2S1 = rowMeans(select(data, w2bf_8, w2bf_48, w2bf_68, w2bf_78, w2bf_88),na.rm = T),
          orderW3S1 = rowMeans(select(data, w3bf_8, w3bf_48, w3bf_68, w3bf_78, w3bf_88),na.rm = T),
          orderW4S1 = rowMeans(select(data, w4bf_8, w4bf_48, w4bf_68, w4bf_78, w4bf_88),na.rm = T),

          # second self parcel
          orderW1S2 = rowMeans(select(data, w1bf_18, w1bf_28, w1bf_38, w1bf_58, w1bf_98),na.rm = T),
          orderW2S2 = rowMeans(select(data, w2bf_18, w2bf_28, w2bf_38, w2bf_58, w2bf_98),na.rm = T),
          orderW3S2 = rowMeans(select(data, w3bf_18, w3bf_28, w3bf_38, w3bf_58, w3bf_98),na.rm = T),
          orderW4S2 = rowMeans(select(data, w4bf_18, w4bf_28, w4bf_38, w4bf_58, w4bf_98),na.rm = T),

          # first peer parcel
          orderW1P1 = rowMeans(select(data, pw1bf_18, pw1bf_28, pw1bf_48, pw1bf_58, pw1bf_68), na.rm = T
          orderW2P1 = rowMeans(select(data, pw2bf_18, pw2bf_28, pw2bf_48, pw2bf_58, pw2bf_68), na.rm = T
          orderW3P1 = rowMeans(select(data, pw3bf_18, pw3bf_28, pw3bf_48, pw3bf_58, pw3bf_68), na.rm = T
          orderW4P1 = rowMeans(select(data, pw4bf_18, pw4bf_28, pw4bf_48, pw4bf_58, pw4bf_68), na.rm = T
```

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        # second peer parcel
        orderW1P2 = rowMeans(select(data, pw1bf_8, pw1bf_38, pw1bf_78, pw1bf_88, pw1bf_98), na.rm = T)
        orderW2P2 = rowMeans(select(data, pw2bf_8, pw2bf_38, pw2bf_78, pw2bf_88, pw2bf_98), na.rm = T)
        orderW3P2 = rowMeans(select(data, pw3bf_8, pw3bf_38, pw3bf_78, pw3bf_88, pw3bf_98), na.rm = T)
        orderW4P2 = rowMeans(select(data, pw4bf_8, pw4bf_38, pw4bf_78, pw4bf_88, pw4bf_98), na.rm = T))

# politeness
data <- data %>%
  mutate(# self
        politW1S = rowMeans(select(data, w1bf_7, w1bf_17, w1bf_27, w1bf_37, w1bf_47, w1bf_57,
                                   w1bf_67, w1bf_77, w1bf_87, w1bf_97), na.rm = T),
        politW2S = rowMeans(select(data, w2bf_7, w2bf_17, w2bf_27, w2bf_37, w2bf_47, w2bf_57,
                                   w2bf_67, w2bf_77, w2bf_87, w2bf_97), na.rm = T),
        politW3S = rowMeans(select(data, w3bf_7, w3bf_17, w3bf_27, w3bf_37, w3bf_47, w3bf_57,
                                   w3bf_67, w3bf_77, w3bf_87, w3bf_97), na.rm = T),
        politW4S = rowMeans(select(data, w4bf_7, w4bf_17, w4bf_27, w4bf_37, w4bf_47, w4bf_57,
                                   w4bf_67, w4bf_77, w4bf_87, w4bf_97), na.rm = T),

        # peer
        politW1P = rowMeans(select(data, pw1bf_7, pw1bf_17, pw1bf_27, pw1bf_37, pw1bf_47, pw1bf_57,
                                   pw1bf_67, pw1bf_77, pw1bf_87, pw1bf_97), na.rm = T),
        politW2P = rowMeans(select(data, pw2bf_7, pw2bf_17, pw2bf_27, pw2bf_37, pw2bf_47, pw2bf_57,
                                   pw2bf_67, pw2bf_77, pw2bf_87, pw2bf_97), na.rm = T),
        politW3P = rowMeans(select(data, pw3bf_7, pw3bf_17, pw3bf_27, pw3bf_37, pw3bf_47, pw3bf_57,
                                   pw3bf_67, pw3bf_77, pw3bf_87, pw3bf_97), na.rm = T),
        politW4P = rowMeans(select(data, pw4bf_7, pw4bf_17, pw4bf_27, pw4bf_37, pw4bf_47, pw4bf_57,
                                   pw4bf_67, pw4bf_77, pw4bf_87, pw4bf_97), na.rm = T))

data <- data %>%
  mutate(# first self parcel
        politW1S1 = rowMeans(select(data, w1bf_7, w1bf_47, w1bf_67, w1bf_77, w1bf_87),na.rm = T),
        politW2S1 = rowMeans(select(data, w2bf_7, w2bf_47, w2bf_67, w2bf_77, w2bf_87),na.rm = T),
        politW3S1 = rowMeans(select(data, w3bf_7, w3bf_47, w3bf_67, w3bf_77, w3bf_87),na.rm = T),
        politW4S1 = rowMeans(select(data, w4bf_7, w4bf_47, w4bf_67, w4bf_77, w4bf_87),na.rm = T),

        # second self parcel
        politW1S2 = rowMeans(select(data, w1bf_17, w1bf_27, w1bf_37, w1bf_57, w1bf_97),na.rm = T),
        politW2S2 = rowMeans(select(data, w2bf_17, w2bf_27, w2bf_37, w2bf_57, w2bf_97),na.rm = T),
        politW3S2 = rowMeans(select(data, w3bf_17, w3bf_27, w3bf_37, w3bf_57, w3bf_97),na.rm = T),
        politW4S2 = rowMeans(select(data, w4bf_17, w4bf_27, w4bf_37, w4bf_57, w4bf_97),na.rm = T),

        # first peer parcel
        politW1P1 = rowMeans(select(data, pw1bf_17, pw1bf_27, pw1bf_47, pw1bf_57, pw1bf_67), na.rm = T)
        politW2P1 = rowMeans(select(data, pw2bf_17, pw2bf_27, pw2bf_47, pw2bf_57, pw2bf_67), na.rm = T)
        politW3P1 = rowMeans(select(data, pw3bf_17, pw3bf_27, pw3bf_47, pw3bf_57, pw3bf_67), na.rm = T)
        politW4P1 = rowMeans(select(data, pw4bf_17, pw4bf_27, pw4bf_47, pw4bf_57, pw4bf_67), na.rm = T)

        # second peer parcel
        politW1P2 = rowMeans(select(data, pw1bf_7, pw1bf_37, pw1bf_77, pw1bf_87, pw1bf_97), na.rm = T)
        politW2P2 = rowMeans(select(data, pw2bf_7, pw2bf_37, pw2bf_77, pw2bf_87, pw2bf_97), na.rm = T)
        politW3P2 = rowMeans(select(data, pw3bf_7, pw3bf_37, pw3bf_77, pw3bf_87, pw3bf_97), na.rm = T)
        politW4P2 = rowMeans(select(data, pw4bf_7, pw4bf_37, pw4bf_77, pw4bf_87, pw4bf_97), na.rm = T))
```

```r
# volatility
data <- data %>%
  mutate(# self
         volatW1S = rowMeans(select(data, w1bf_6, w1bf_16, w1bf_26, w1bf_36, w1bf_46, w1bf_56,
                                    w1bf_66, w1bf_76, w1bf_86, w1bf_96), na.rm = T),
         volatW2S = rowMeans(select(data, w2bf_6, w2bf_16, w2bf_26, w2bf_36, w2bf_46, w2bf_56,
                                    w2bf_66, w2bf_76, w2bf_86, w2bf_96), na.rm = T),
         volatW3S = rowMeans(select(data, w3bf_6, w3bf_16, w3bf_26, w3bf_36, w3bf_46, w3bf_56,
                                    w3bf_66, w3bf_76, w3bf_86, w3bf_96), na.rm = T),
         volatW4S = rowMeans(select(data, w4bf_6, w4bf_16, w4bf_26, w4bf_36, w4bf_46, w4bf_56,
                                    w4bf_66, w4bf_76, w4bf_86, w4bf_96), na.rm = T),

         # peer
         volatW1P = rowMeans(select(data, pw1bf_6, pw1bf_16, pw1bf_26, pw1bf_36, pw1bf_46, pw1bf_56,
                                    pw1bf_66, pw1bf_76, pw1bf_86, pw1bf_96), na.rm = T),
         volatW2P = rowMeans(select(data, pw2bf_6, pw2bf_16, pw2bf_26, pw2bf_36, pw2bf_46, pw2bf_56,
                                    pw2bf_66, pw2bf_76, pw2bf_86, pw2bf_96), na.rm = T),
         volatW3P = rowMeans(select(data, pw3bf_6, pw3bf_16, pw3bf_26, pw3bf_36, pw3bf_46, pw3bf_56,
                                    pw3bf_66, pw3bf_76, pw3bf_86, pw3bf_96), na.rm = T),
         volatW4P = rowMeans(select(data, pw4bf_6, pw4bf_16, pw4bf_26, pw4bf_36, pw4bf_46, pw4bf_56,
                                    pw4bf_66, pw4bf_76, pw4bf_86, pw4bf_96), na.rm = T))

data <- data %>%
  mutate(# first self parcel
         volatW1S1 = rowMeans(select(data, w1bf_6, w1bf_46, w1bf_66, w1bf_76, w1bf_86),na.rm = T),
         volatW2S1 = rowMeans(select(data, w2bf_6, w2bf_46, w2bf_66, w2bf_76, w2bf_86),na.rm = T),
         volatW3S1 = rowMeans(select(data, w3bf_6, w3bf_46, w3bf_66, w3bf_76, w3bf_86),na.rm = T),
         volatW4S1 = rowMeans(select(data, w4bf_6, w4bf_46, w4bf_66, w4bf_76, w4bf_86),na.rm = T),

         # second self parcel
         volatW1S2 = rowMeans(select(data, w1bf_16, w1bf_26, w1bf_36, w1bf_56, w1bf_96),na.rm = T),
         volatW2S2 = rowMeans(select(data, w2bf_16, w2bf_26, w2bf_36, w2bf_56, w2bf_96),na.rm = T),
         volatW3S2 = rowMeans(select(data, w3bf_16, w3bf_26, w3bf_36, w3bf_56, w3bf_96),na.rm = T),
         volatW4S2 = rowMeans(select(data, w4bf_16, w4bf_26, w4bf_36, w4bf_56, w4bf_96),na.rm = T),

         # first peer parcel
         volatW1P1 = rowMeans(select(data, pw1bf_16, pw1bf_26, pw1bf_46, pw1bf_56, pw1bf_66), na.rm = T)
         volatW2P1 = rowMeans(select(data, pw2bf_16, pw2bf_26, pw2bf_46, pw2bf_56, pw2bf_66), na.rm = T)
         volatW3P1 = rowMeans(select(data, pw3bf_16, pw3bf_26, pw3bf_46, pw3bf_56, pw3bf_66), na.rm = T)
         volatW4P1 = rowMeans(select(data, pw4bf_16, pw4bf_26, pw4bf_46, pw4bf_56, pw4bf_66), na.rm = T)

         # second peer parcel
         volatW1P2 = rowMeans(select(data, pw1bf_6, pw1bf_36, pw1bf_76, pw1bf_86, pw1bf_96), na.rm = T)
         volatW2P2 = rowMeans(select(data, pw2bf_6, pw2bf_36, pw2bf_76, pw2bf_86, pw2bf_96), na.rm = T)
         volatW3P2 = rowMeans(select(data, pw3bf_6, pw3bf_36, pw3bf_76, pw3bf_86, pw3bf_96), na.rm = T)
         volatW4P2 = rowMeans(select(data, pw4bf_6, pw4bf_36, pw4bf_76, pw4bf_86, pw4bf_96), na.rm = T)

# withdrawal
data <- data %>%
  mutate(# self
         withdW1S = rowMeans(select(data, w1bf_1, w1bf_11, w1bf_21, w1bf_31, w1bf_41, w1bf_51,
                                    w1bf_61, w1bf_71, w1bf_81, w1bf_91), na.rm = T),
         withdW2S = rowMeans(select(data, w2bf_1, w2bf_11, w2bf_21, w2bf_31, w2bf_41, w2bf_51,
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                                       w2bf_61, w2bf_71, w2bf_81, w2bf_91), na.rm = T),
         withdW3S = rowMeans(select(data, w3bf_1, w3bf_11, w3bf_21, w3bf_31, w3bf_41, w3bf_51,
                                       w3bf_61, w3bf_71, w3bf_81, w3bf_91), na.rm = T),
         withdW4S = rowMeans(select(data, w4bf_1, w4bf_11, w4bf_21, w4bf_31, w4bf_41, w4bf_51,
                                       w4bf_61, w4bf_71, w4bf_81, w4bf_91), na.rm = T),

         # peer
         withdW1P = rowMeans(select(data, pw1bf_1, pw1bf_11, pw1bf_21, pw1bf_31, pw1bf_41, pw1bf_51,
                                       pw1bf_61, pw1bf_71, pw1bf_81, pw1bf_91), na.rm = T),
         withdW2P = rowMeans(select(data, pw2bf_1, pw2bf_11, pw2bf_21, pw2bf_31, pw2bf_41, pw2bf_51,
                                       pw2bf_61, pw2bf_71, pw2bf_81, pw2bf_91), na.rm = T),
         withdW3P = rowMeans(select(data, pw3bf_1, pw3bf_11, pw3bf_21, pw3bf_31, pw3bf_41, pw3bf_51,
                                       pw3bf_61, pw3bf_71, pw3bf_81, pw3bf_91), na.rm = T),
         withdW4P = rowMeans(select(data, pw4bf_1, pw4bf_11, pw4bf_21, pw4bf_31, pw4bf_41, pw4bf_51,
                                       pw4bf_61, pw4bf_71, pw4bf_81, pw4bf_91), na.rm = T))

data <- data %>%
  mutate(# first self parcel
         withdW1S1 = rowMeans(select(data, w1bf_1, w1bf_41, w1bf_61, w1bf_71, w1bf_81),na.rm = T),
         withdW2S1 = rowMeans(select(data, w2bf_1, w2bf_41, w2bf_61, w2bf_71, w2bf_81),na.rm = T),
         withdW3S1 = rowMeans(select(data, w3bf_1, w3bf_41, w3bf_61, w3bf_71, w3bf_81),na.rm = T),
         withdW4S1 = rowMeans(select(data, w4bf_1, w4bf_41, w4bf_61, w4bf_71, w4bf_81),na.rm = T),

         # second self parcel
         withdW1S2 = rowMeans(select(data, w1bf_11, w1bf_21, w1bf_31, w1bf_51, w1bf_91),na.rm = T),
         withdW2S2 = rowMeans(select(data, w2bf_11, w2bf_21, w2bf_31, w2bf_51, w2bf_91),na.rm = T),
         withdW3S2 = rowMeans(select(data, w3bf_11, w3bf_21, w3bf_31, w3bf_51, w3bf_91),na.rm = T),
         withdW4S2 = rowMeans(select(data, w4bf_11, w4bf_21, w4bf_31, w4bf_51, w4bf_91),na.rm = T),

         # first peer parcel
         withdW1P1 = rowMeans(select(data, pw1bf_11, pw1bf_21, pw1bf_41, pw1bf_51, pw1bf_61), na.rm = T
         withdW2P1 = rowMeans(select(data, pw2bf_11, pw2bf_21, pw2bf_41, pw2bf_51, pw2bf_61), na.rm = T
         withdW3P1 = rowMeans(select(data, pw3bf_11, pw3bf_21, pw3bf_41, pw3bf_51, pw3bf_61), na.rm = T
         withdW4P1 = rowMeans(select(data, pw4bf_11, pw4bf_21, pw4bf_41, pw4bf_51, pw4bf_61), na.rm = T

         # second peer parcel
         withdW1P2 = rowMeans(select(data, pw1bf_1, pw1bf_31, pw1bf_71, pw1bf_81, pw1bf_91), na.rm = T)
         withdW2P2 = rowMeans(select(data, pw2bf_1, pw2bf_31, pw2bf_71, pw2bf_81, pw2bf_91), na.rm = T)
         withdW3P2 = rowMeans(select(data, pw3bf_1, pw3bf_31, pw3bf_71, pw3bf_81, pw3bf_91), na.rm = T)
         withdW4P2 = rowMeans(select(data, pw4bf_1, pw4bf_31, pw4bf_71, pw4bf_81, pw4bf_91), na.rm = T)

# >>> Domains ----

### agreeableness
data <- data %>%
  mutate(# first self parcel
         agreeW1S1 = rowMeans(select(data, w1bf_12, w1bf_32, w1bf_42, w1bf_62, w1bf_72,
                                       w1bf_92, w1bf_17, w1bf_37, w1bf_47, w1bf_97),na.rm = T),
         agreeW2S1 = rowMeans(select(data, w2bf_12, w2bf_32, w2bf_42, w2bf_62, w2bf_72,
                                       w2bf_92, w2bf_17, w2bf_37, w2bf_47, w2bf_97),na.rm = T),
         agreeW3S1 = rowMeans(select(data, w3bf_12, w3bf_32, w3bf_42, w3bf_62, w3bf_72,
                                       w3bf_92, w3bf_17, w3bf_37, w3bf_47, w3bf_97),na.rm = T),
         agreeW4S1 = rowMeans(select(data, w4bf_12, w4bf_32, w4bf_42, w4bf_62, w4bf_72,
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                                              w4bf_92, w4bf_17, w4bf_37, w4bf_47, w4bf_97),na.rm = T),

         # second self parcel
         agreeW1S2 = rowMeans(select(data, w1bf_2, w1bf_22, w1bf_52, w1bf_82, w1bf_7,
                                     w1bf_27, w1bf_57, w1bf_67, w1bf_77, w1bf_87),na.rm = T),
         agreeW2S2 = rowMeans(select(data, w2bf_2, w2bf_22, w2bf_52, w2bf_82, w2bf_7,
                                     w2bf_27, w2bf_57, w2bf_67, w2bf_77, w2bf_87),na.rm = T),
         agreeW3S2 = rowMeans(select(data, w3bf_2, w3bf_22, w3bf_52, w3bf_82, w3bf_7,
                                     w3bf_27, w3bf_57, w3bf_67, w3bf_77, w3bf_87),na.rm = T),
         agreeW4S2 = rowMeans(select(data, w4bf_2, w4bf_22, w4bf_52, w4bf_82, w4bf_7,
                                     w4bf_27, w4bf_57, w4bf_67, w4bf_77, w4bf_87),na.rm = T),

         # first peer parcel
         agreeW1P1 = rowMeans(select(data, pw1bf_2, pw1bf_22, pw1bf_32, pw1bf_42, pw1bf_82,
                                     pw1bf_17, pw1bf_37, pw1bf_47, pw1bf_57, pw1bf_87), na.rm = T),
         agreeW2P1 = rowMeans(select(data, pw2bf_2, pw2bf_22, pw2bf_32, pw2bf_42, pw2bf_82,
                                     pw2bf_17, pw2bf_37, pw2bf_47, pw2bf_57, pw2bf_87), na.rm = T),
         agreeW3P1 = rowMeans(select(data, pw3bf_2, pw3bf_22, pw3bf_32, pw3bf_42, pw3bf_82,
                                     pw3bf_17, pw3bf_37, pw3bf_47, pw3bf_57, pw3bf_87), na.rm = T),
         agreeW4P1 = rowMeans(select(data, pw4bf_2, pw4bf_22, pw4bf_32, pw4bf_42, pw4bf_82,
                                     pw4bf_17, pw4bf_37, pw4bf_47, pw4bf_57, pw4bf_87), na.rm = T),

         # second peer parcel
         agreeW1P2 = rowMeans(select(data, pw1bf_12, pw1bf_52, pw1bf_62, pw1bf_72, pw1bf_92,
                                     pw1bf_7, pw1bf_27, pw1bf_67, pw1bf_77, pw1bf_97), na.rm = T),
         agreeW2P2 = rowMeans(select(data, pw1bf_12, pw1bf_52, pw1bf_62, pw1bf_72, pw1bf_92,
                                     pw1bf_7, pw1bf_27, pw1bf_67, pw1bf_77, pw1bf_97), na.rm = T),
         agreeW3P2 = rowMeans(select(data, pw1bf_12, pw1bf_52, pw1bf_62, pw1bf_72, pw1bf_92,
                                     pw1bf_7, pw1bf_27, pw1bf_67, pw1bf_77, pw1bf_97), na.rm = T),
         agreeW4P2 = rowMeans(select(data, pw1bf_12, pw1bf_52, pw1bf_62, pw1bf_72, pw1bf_92,
                                     pw1bf_7, pw1bf_27, pw1bf_67, pw1bf_77, pw1bf_97), na.rm = T))

### conscientiousness
data <- data %>%
  mutate(# first self parcel
         consciW1S1 = rowMeans(select(data, w1bf_13, w1bf_33, w1bf_43, w1bf_63, w1bf_73,
                                      w1bf_93, w1bf_18, w1bf_38, w1bf_48, w1bf_98),na.rm = T),
         consciW2S1 = rowMeans(select(data, w2bf_13, w2bf_33, w2bf_43, w2bf_63, w2bf_73,
                                      w2bf_93, w2bf_18, w2bf_38, w2bf_48, w2bf_98),na.rm = T),
         consciW3S1 = rowMeans(select(data, w3bf_13, w3bf_33, w3bf_43, w3bf_63, w3bf_73,
                                      w3bf_93, w3bf_18, w3bf_38, w3bf_48, w3bf_98),na.rm = T),
         consciW4S1 = rowMeans(select(data, w4bf_13, w4bf_33, w4bf_43, w4bf_63, w4bf_73,
                                      w4bf_93, w4bf_18, w4bf_38, w4bf_48, w4bf_98),na.rm = T),

         # second self parcel
         consciW1S2 = rowMeans(select(data, w1bf_3, w1bf_23, w1bf_53, w1bf_83, w1bf_8,
                                      w1bf_28, w1bf_58, w1bf_68, w1bf_78, w1bf_88),na.rm = T),
         consciW2S2 = rowMeans(select(data, w2bf_3, w2bf_23, w2bf_53, w2bf_83, w2bf_8,
                                      w2bf_28, w2bf_58, w2bf_68, w2bf_78, w2bf_88),na.rm = T),
         consciW3S2 = rowMeans(select(data, w3bf_3, w3bf_23, w3bf_53, w3bf_83, w3bf_8,
                                      w3bf_28, w3bf_58, w3bf_68, w3bf_78, w3bf_88),na.rm = T),
         consciW4S2 = rowMeans(select(data, w4bf_3, w4bf_23, w4bf_53, w4bf_83, w4bf_8,
                                      w4bf_28, w4bf_58, w4bf_68, w4bf_78, w4bf_88),na.rm = T),
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        # first peer parcel
        consciW1P1 = rowMeans(select(data, pw1bf_3, pw1bf_23, pw1bf_33, pw1bf_43, pw1bf_83,
                                pw1bf_18, pw1bf_38, pw1bf_48, pw1bf_58, pw1bf_88), na.rm = T),
        consciW2P1 = rowMeans(select(data, pw2bf_3, pw2bf_23, pw2bf_33, pw2bf_43, pw2bf_83,
                                pw2bf_18, pw2bf_38, pw2bf_48, pw2bf_58, pw2bf_88), na.rm = T),
        consciW3P1 = rowMeans(select(data, pw3bf_3, pw3bf_23, pw3bf_33, pw3bf_43, pw3bf_83,
                                pw3bf_18, pw3bf_38, pw3bf_48, pw3bf_58, pw3bf_88), na.rm = T),
        consciW4P1 = rowMeans(select(data, pw4bf_3, pw4bf_23, pw4bf_33, pw4bf_43, pw4bf_83,
                                pw4bf_18, pw4bf_38, pw4bf_48, pw4bf_58, pw4bf_88), na.rm = T),

        # second peer parcel
        consciW1P2 = rowMeans(select(data, pw1bf_13, pw1bf_53, pw1bf_63, pw1bf_73, pw1bf_93,
                                pw1bf_8, pw1bf_28, pw1bf_68, pw1bf_78, pw1bf_98), na.rm = T),
        consciW2P2 = rowMeans(select(data, pw1bf_13, pw1bf_53, pw1bf_63, pw1bf_73, pw1bf_93,
                                pw1bf_8, pw1bf_28, pw1bf_68, pw1bf_78, pw1bf_98), na.rm = T),
        consciW3P2 = rowMeans(select(data, pw1bf_13, pw1bf_53, pw1bf_63, pw1bf_73, pw1bf_93,
                                pw1bf_8, pw1bf_28, pw1bf_68, pw1bf_78, pw1bf_98), na.rm = T),
        consciW4P2 = rowMeans(select(data, pw1bf_13, pw1bf_53, pw1bf_63, pw1bf_73, pw1bf_93,
                                pw1bf_8, pw1bf_28, pw1bf_68, pw1bf_78, pw1bf_98), na.rm = T))

### extraversion
data <- data %>%
  mutate(# first self parcel
        extraW1S1 = rowMeans(select(data, w1bf_14, w1bf_34, w1bf_44, w1bf_64, w1bf_74,
                                w1bf_94, w1bf_19, w1bf_39, w1bf_49, w1bf_99),na.rm = T),
        extraW2S1 = rowMeans(select(data, w2bf_14, w2bf_34, w2bf_44, w2bf_64, w2bf_74,
                                w2bf_94, w2bf_19, w2bf_39, w2bf_49, w2bf_99),na.rm = T),
        extraW3S1 = rowMeans(select(data, w3bf_14, w3bf_34, w3bf_44, w3bf_64, w3bf_74,
                                w3bf_94, w3bf_19, w3bf_39, w3bf_49, w3bf_99),na.rm = T),
        extraW4S1 = rowMeans(select(data, w4bf_14, w4bf_34, w4bf_44, w4bf_64, w4bf_74,
                                w4bf_94, w4bf_19, w4bf_39, w4bf_49, w4bf_99),na.rm = T),

        # second self parcel
        extraW1S2 = rowMeans(select(data, w1bf_4, w1bf_24, w1bf_54, w1bf_84, w1bf_9,
                                w1bf_29, w1bf_59, w1bf_69, w1bf_79, w1bf_89),na.rm = T),
        extraW2S2 = rowMeans(select(data, w2bf_4, w2bf_24, w2bf_54, w2bf_84, w2bf_9,
                                w2bf_29, w2bf_59, w2bf_69, w2bf_79, w2bf_89),na.rm = T),
        extraW3S2 = rowMeans(select(data, w3bf_4, w3bf_24, w3bf_54, w3bf_84, w3bf_9,
                                w3bf_29, w3bf_59, w3bf_69, w3bf_79, w3bf_89),na.rm = T),
        extraW4S2 = rowMeans(select(data, w4bf_4, w4bf_24, w4bf_54, w4bf_84, w4bf_9,
                                w4bf_29, w4bf_59, w4bf_69, w4bf_79, w4bf_89),na.rm = T),

        # first peer parcel
        extraW1P1 = rowMeans(select(data, pw1bf_4, pw1bf_24, pw1bf_34, pw1bf_44, pw1bf_84,
                                pw1bf_19, pw1bf_39, pw1bf_49, pw1bf_59, pw1bf_89), na.rm = T),
        extraW2P1 = rowMeans(select(data, pw2bf_4, pw2bf_24, pw2bf_34, pw2bf_44, pw2bf_84,
                                pw2bf_19, pw2bf_39, pw2bf_49, pw2bf_59, pw2bf_89), na.rm = T),
        extraW3P1 = rowMeans(select(data, pw3bf_4, pw3bf_24, pw3bf_34, pw3bf_44, pw3bf_84,
                                pw3bf_19, pw3bf_39, pw3bf_49, pw3bf_59, pw3bf_89), na.rm = T),
        extraW4P1 = rowMeans(select(data, pw4bf_4, pw4bf_24, pw4bf_34, pw4bf_44, pw4bf_84,
                                pw4bf_19, pw4bf_39, pw4bf_49, pw4bf_59, pw4bf_89), na.rm = T),

        # second peer parcel
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        extraW1P2 = rowMeans(select(data, pw1bf_14, pw1bf_54, pw1bf_64, pw1bf_74, pw1bf_94,
                                    pw1bf_9, pw1bf_29, pw1bf_69, pw1bf_79, pw1bf_99), na.rm = T),
        extraW2P2 = rowMeans(select(data, pw1bf_14, pw1bf_54, pw1bf_64, pw1bf_74, pw1bf_94,
                                    pw1bf_9, pw1bf_29, pw1bf_69, pw1bf_79, pw1bf_99), na.rm = T),
        extraW3P2 = rowMeans(select(data, pw1bf_14, pw1bf_54, pw1bf_64, pw1bf_74, pw1bf_94,
                                    pw1bf_9, pw1bf_29, pw1bf_69, pw1bf_79, pw1bf_99), na.rm = T),
        extraW4P2 = rowMeans(select(data, pw1bf_14, pw1bf_54, pw1bf_64, pw1bf_74, pw1bf_94,
                                    pw1bf_9, pw1bf_29, pw1bf_69, pw1bf_79, pw1bf_99), na.rm = T))

### neuroticism
data <- data %>%
  mutate(# first self parcel
        neuroW1S1 = rowMeans(select(data, w1bf_11, w1bf_31, w1bf_41, w1bf_61, w1bf_71,
                                    w1bf_91, w1bf_16, w1bf_36, w1bf_46, w1bf_96),na.rm = T),
        neuroW2S1 = rowMeans(select(data, w2bf_11, w2bf_31, w2bf_41, w2bf_61, w2bf_71,
                                    w2bf_91, w2bf_16, w2bf_36, w2bf_46, w2bf_96),na.rm = T),
        neuroW3S1 = rowMeans(select(data, w3bf_11, w3bf_31, w3bf_41, w3bf_61, w3bf_71,
                                    w3bf_91, w3bf_16, w3bf_36, w3bf_46, w3bf_96),na.rm = T),
        neuroW4S1 = rowMeans(select(data, w4bf_11, w4bf_31, w4bf_41, w4bf_61, w4bf_71,
                                    w4bf_91, w4bf_16, w4bf_36, w4bf_46, w4bf_96),na.rm = T),

        # second self parcel
        neuroW1S2 = rowMeans(select(data, w1bf_1, w1bf_21, w1bf_51, w1bf_81, w1bf_6,
                                    w1bf_26, w1bf_56, w1bf_66, w1bf_76, w1bf_86),na.rm = T),
        neuroW2S2 = rowMeans(select(data, w2bf_1, w2bf_21, w2bf_51, w2bf_81, w2bf_6,
                                    w2bf_26, w2bf_56, w2bf_66, w2bf_76, w2bf_86),na.rm = T),
        neuroW3S2 = rowMeans(select(data, w3bf_1, w3bf_21, w3bf_51, w3bf_81, w3bf_6,
                                    w3bf_26, w3bf_56, w3bf_66, w3bf_76, w3bf_86),na.rm = T),
        neuroW4S2 = rowMeans(select(data, w4bf_1, w4bf_21, w4bf_51, w4bf_81, w4bf_6,
                                    w4bf_26, w4bf_56, w4bf_66, w4bf_76, w4bf_86),na.rm = T),

        # first peer parcel
        neuroW1P1 = rowMeans(select(data, pw1bf_1, pw1bf_21, pw1bf_31, pw1bf_41, pw1bf_81,
                                    pw1bf_16, pw1bf_36, pw1bf_46, pw1bf_56, pw1bf_86), na.rm = T),
        neuroW2P1 = rowMeans(select(data, pw2bf_1, pw2bf_21, pw2bf_31, pw2bf_41, pw2bf_81,
                                    pw2bf_16, pw2bf_36, pw2bf_46, pw2bf_56, pw2bf_86), na.rm = T),
        neuroW3P1 = rowMeans(select(data, pw3bf_1, pw3bf_21, pw3bf_31, pw3bf_41, pw3bf_81,
                                    pw3bf_16, pw3bf_36, pw3bf_46, pw3bf_56, pw3bf_86), na.rm = T),
        neuroW4P1 = rowMeans(select(data, pw4bf_1, pw4bf_21, pw4bf_31, pw4bf_41, pw4bf_81,
                                    pw4bf_16, pw4bf_36, pw4bf_46, pw4bf_56, pw4bf_86), na.rm = T),

        # second peer parcel
        neuroW1P2 = rowMeans(select(data, pw1bf_11, pw1bf_51, pw1bf_61, pw1bf_71, pw1bf_91,
                                    pw1bf_6, pw1bf_26, pw1bf_66, pw1bf_76, pw1bf_96), na.rm = T),
        neuroW2P2 = rowMeans(select(data, pw1bf_11, pw1bf_51, pw1bf_61, pw1bf_71, pw1bf_91,
                                    pw1bf_6, pw1bf_26, pw1bf_66, pw1bf_76, pw1bf_96), na.rm = T),
        neuroW3P2 = rowMeans(select(data, pw1bf_11, pw1bf_51, pw1bf_61, pw1bf_71, pw1bf_91,
                                    pw1bf_6, pw1bf_26, pw1bf_66, pw1bf_76, pw1bf_96), na.rm = T),
        neuroW4P2 = rowMeans(select(data, pw1bf_11, pw1bf_51, pw1bf_61, pw1bf_71, pw1bf_91,
                                    pw1bf_6, pw1bf_26, pw1bf_66, pw1bf_76, pw1bf_96), na.rm = T))

### openness domain
data <- data %>%
```

```r
  mutate(# first self parcel
         opendW1S1 = rowMeans(select(data, w1bf_10, w1bf_30, w1bf_40, w1bf_60, w1bf_70,
                                     w1bf_90, w1bf_15, w1bf_35, w1bf_45, w1bf_95),na.rm = T),
         opendW2S1 = rowMeans(select(data, w2bf_10, w2bf_30, w2bf_40, w2bf_60, w2bf_70,
                                     w2bf_90, w2bf_15, w2bf_35, w2bf_45, w2bf_95),na.rm = T),
         opendW3S1 = rowMeans(select(data, w3bf_10, w3bf_30, w3bf_40, w3bf_60, w3bf_70,
                                     w3bf_90, w3bf_15, w3bf_35, w3bf_45, w3bf_95),na.rm = T),
         opendW4S1 = rowMeans(select(data, w4bf_10, w4bf_30, w4bf_40, w4bf_60, w4bf_70,
                                     w4bf_90, w4bf_15, w4bf_35, w4bf_45, w4bf_95),na.rm = T),

         # second self parcel
         opendW1S2 = rowMeans(select(data, w1bf_100, w1bf_20, w1bf_50, w1bf_80, w1bf_5,
                                     w1bf_25, w1bf_55, w1bf_65, w1bf_75, w1bf_85),na.rm = T),
         opendW2S2 = rowMeans(select(data, w2bf_100, w2bf_20, w2bf_50, w2bf_80, w2bf_5,
                                     w2bf_25, w2bf_55, w2bf_65, w2bf_75, w2bf_85),na.rm = T),
         opendW3S2 = rowMeans(select(data, w3bf_100, w3bf_20, w3bf_50, w3bf_80, w3bf_5,
                                     w3bf_25, w3bf_55, w3bf_65, w3bf_75, w3bf_85),na.rm = T),
         opendW4S2 = rowMeans(select(data, w4bf_100, w4bf_20, w4bf_50, w4bf_80, w4bf_5,
                                     w4bf_25, w4bf_55, w4bf_65, w4bf_75, w4bf_85),na.rm = T),

         # first peer parcel
         opendW1P1 = rowMeans(select(data, pw1bf_100, pw1bf_20, pw1bf_30, pw1bf_40, pw1bf_80,
                                     pw1bf_15, pw1bf_35, pw1bf_45, pw1bf_55, pw1bf_85), na.rm = T),
         opendW2P1 = rowMeans(select(data, pw2bf_100, pw2bf_20, pw2bf_30, pw2bf_40, pw2bf_80,
                                     pw2bf_15, pw2bf_35, pw2bf_45, pw2bf_55, pw2bf_85), na.rm = T),
         opendW3P1 = rowMeans(select(data, pw3bf_100, pw3bf_20, pw3bf_30, pw3bf_40, pw3bf_80,
                                     pw3bf_15, pw3bf_35, pw3bf_45, pw3bf_55, pw3bf_85), na.rm = T),
         opendW4P1 = rowMeans(select(data, pw4bf_100, pw4bf_20, pw4bf_30, pw4bf_40, pw4bf_80,
                                     pw4bf_15, pw4bf_35, pw4bf_45, pw4bf_55, pw4bf_85), na.rm = T),

         # second peer parcel
         opendW1P2 = rowMeans(select(data, pw1bf_10, pw1bf_50, pw1bf_60, pw1bf_70, pw1bf_90,
                                     pw1bf_5, pw1bf_25, pw1bf_65, pw1bf_75, pw1bf_95), na.rm = T),
         opendW2P2 = rowMeans(select(data, pw1bf_10, pw1bf_50, pw1bf_60, pw1bf_70, pw1bf_90,
                                     pw1bf_5, pw1bf_25, pw1bf_65, pw1bf_75, pw1bf_95), na.rm = T),
         opendW3P2 = rowMeans(select(data, pw1bf_10, pw1bf_50, pw1bf_60, pw1bf_70, pw1bf_90,
                                     pw1bf_5, pw1bf_25, pw1bf_65, pw1bf_75, pw1bf_95), na.rm = T),
         opendW4P2 = rowMeans(select(data, pw1bf_10, pw1bf_50, pw1bf_60, pw1bf_70, pw1bf_90,
                                     pw1bf_5, pw1bf_25, pw1bf_65, pw1bf_75, pw1bf_95), na.rm = T))


# >>> Identity ----

### Confusion
data <- data %>%
  mutate(# first self parcel
         confuW1S1 = rowMeans(select(data, w1epsi_7, w1epsi_10, w1epsi_11),na.rm = T),
         confuW2S1 = rowMeans(select(data, w2epsi_7, w2epsi_10, w2epsi_11),na.rm = T),
         confuW3S1 = rowMeans(select(data, w3epsi_7, w3epsi_10, w3epsi_11),na.rm = T),
         confuW4S1 = rowMeans(select(data, w4epsi_7, w4epsi_10, w4epsi_11),na.rm = T),

         # second self parcel
         confuW1S2 = rowMeans(select(data, w1epsi_1, w1epsi_3, w1epsi_12),na.rm = T),
```

```r
        confuW2S2 = rowMeans(select(data, w2epsi_1, w2epsi_3, w2epsi_12),na.rm = T),
        confuW3S2 = rowMeans(select(data, w3epsi_1, w3epsi_3, w3epsi_12),na.rm = T),
        confuW4S2 = rowMeans(select(data, w4epsi_1, w4epsi_3, w4epsi_12),na.rm = T),

        # first peer parcel
        confuW1P1 = rowMeans(select(data, pw1epsi_3, pw1epsi_7, pw1epsi_12), na.rm = T),
        confuW2P1 = rowMeans(select(data, pw2epsi_3, pw2epsi_7, pw2epsi_12), na.rm = T),
        confuW3P1 = rowMeans(select(data, pw3epsi_3, pw3epsi_7, pw3epsi_12), na.rm = T),
        confuW4P1 = rowMeans(select(data, pw4epsi_3, pw4epsi_7, pw4epsi_12), na.rm = T),

        # second peer parcel
        confuW1P2 = rowMeans(select(data, pw1epsi_1, pw1epsi_10, pw1epsi_11), na.rm = T),
        confuW2P2 = rowMeans(select(data, pw2epsi_1, pw2epsi_10, pw2epsi_11), na.rm = T),
        confuW3P2 = rowMeans(select(data, pw3epsi_1, pw3epsi_10, pw3epsi_11), na.rm = T),
        confuW4P2 = rowMeans(select(data, pw4epsi_1, pw4epsi_10, pw4epsi_11), na.rm = T))

### Coherence
data <- data %>%
  mutate(# first self parcel
        coherW1S1 = rowMeans(select(data, w1epsi_2, w1epsi_5, w1epsi_6),na.rm = T),
        coherW2S1 = rowMeans(select(data, w2epsi_2, w2epsi_5, w2epsi_6),na.rm = T),
        coherW3S1 = rowMeans(select(data, w3epsi_2, w3epsi_5, w3epsi_6),na.rm = T),
        coherW4S1 = rowMeans(select(data, w4epsi_2, w4epsi_5, w4epsi_6),na.rm = T),

        # second self parcel
        coherW1S2 = rowMeans(select(data, w1epsi_4, w1epsi_8, w1epsi_9),na.rm = T),
        coherW2S2 = rowMeans(select(data, w2epsi_4, w2epsi_8, w2epsi_9),na.rm = T),
        coherW3S2 = rowMeans(select(data, w3epsi_4, w3epsi_8, w3epsi_9),na.rm = T),
        coherW4S2 = rowMeans(select(data, w4epsi_4, w4epsi_8, w4epsi_9),na.rm = T),

        # first peer parcel
        coherW1P1 = rowMeans(select(data, pw1epsi_4, pw1epsi_5, pw1epsi_9), na.rm = T),
        coherW2P1 = rowMeans(select(data, pw2epsi_4, pw2epsi_5, pw2epsi_9), na.rm = T),
        coherW3P1 = rowMeans(select(data, pw3epsi_4, pw3epsi_5, pw3epsi_9), na.rm = T),
        coherW4P1 = rowMeans(select(data, pw4epsi_4, pw4epsi_5, pw4epsi_9), na.rm = T),

        # second peer parcel
        coherW1P2 = rowMeans(select(data, pw1epsi_2, pw1epsi_6, pw1epsi_8), na.rm = T),
        coherW2P2 = rowMeans(select(data, pw2epsi_2, pw2epsi_6, pw2epsi_8), na.rm = T),
        coherW3P2 = rowMeans(select(data, pw3epsi_2, pw3epsi_6, pw3epsi_8), na.rm = T),
        coherW4P2 = rowMeans(select(data, pw4epsi_2, pw4epsi_6, pw4epsi_8), na.rm = T))

data[data == "NaN"] <- NA
```

Latent growth model

LGM Agreeableness

with aspects as parcels

```r
lgmAgree <- '

# factor at each time point with same loading
```

```
agree1 =~ compaW1S       + a * politW1S +
         peer * compaW1P + aa * politW1P


agree2 =~ compaW2S       + a * politW2S +
         peer * compaW2P + aa * politW2P


agree3 =~ compaW3S       + a * politW3S +
         peer * compaW3P + aa * politW3P


agree4 =~ compaW4S       + a * politW4S +
         peer * compaW4P + aa * politW4P

# second order factor for intercept and slope
interc =~ 1*agree1 + 1*agree2 + 1*agree3 + 1*agree4
slope =~ 0*agree1 + 6*agree2 + 13*agree3 + 19*agree4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
compaW1S ~ 0*1
compaW2S ~ 0*1
compaW3S ~ 0*1
compaW4S ~ 0*1

# fix equal intercepts
politW1S ~ b*1
politW2S ~ b*1
politW3S ~ b*1
politW4S ~ b*1

compaW1P ~ c*1
compaW2P ~ c*1
compaW3P ~ c*1
compaW4P ~ c*1

politW1P ~ d*1
politW2P ~ d*1
politW3P ~ d*1
politW4P ~ d*1

# error covariance - similar aspects across waves and informants
compaW1S ~~ compaW2S + compaW3S + compaW4S +
            compaW1P + compaW2P + compaW3P + compaW4P
compaW2S ~~ compaW3S + compaW4S +
            compaW1P + compaW2P + compaW3P + compaW4P
compaW3S ~~ compaW4S +
            compaW1P + compaW2P + compaW3P + compaW4P
compaW4S ~~ compaW1P + compaW2P + compaW3P + compaW4P

politW1S ~~ politW2S + politW3S + politW4S +
            politW1P + politW2P + politW3P + politW4P
politW2S ~~ politW3S + politW4S +
```

```
            politW1P + politW2P + politW3P + politW4P
politW3S ~~ politW4S +
            politW1P + politW2P + politW3P + politW4P
politW4S ~~ politW1P + politW2P + politW3P + politW4P

compaW1P ~~ compaW2P + compaW3P + compaW4P
compaW2P ~~ compaW3P + compaW4P
compaW3P ~~ compaW4P

politW1P ~~ politW2P + politW3P + politW4P
politW2P ~~ politW3P + politW4P
politW3P ~~ politW4P
'
lgmAgree <- sem(lgmAgree, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                 but not all elements of the gradient are (near) zero;
##                 the optimizer may not have found a local solution
##                 use check.gradient = FALSE to skip this check.

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                 but not all elements of the gradient are (near) zero;
##                 the optimizer may not have found a local solution
##                 use check.gradient = FALSE to skip this check.

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                 but not all elements of the gradient are (near) zero;
##                 the optimizer may not have found a local solution
##                 use check.gradient = FALSE to skip this check.

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                 but not all elements of the gradient are (near) zero;
##                 the optimizer may not have found a local solution
##                 use check.gradient = FALSE to skip this check.
```

```
summary(lgmAgree, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 did NOT end normally after 1672 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                        105
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA

## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge

##
## Parameter Estimates:
```

```
##
##   Standard errors                                Standard
##   Information                                     Observed
##   Observed information based on                    Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   agree1 =~
##     compW1S            1.000                                 1.000    1.000
##     poltW1S    (a)     0.000       NA                           NA       NA
##     compW1P (peer)     3.473       NA                           NA       NA
##     poltW1P   (aa)     0.001       NA                           NA       NA
##   agree2 =~
##     compW2S            1.000                                 1.000    1.000
##     poltW2S    (a)     0.000       NA                           NA       NA
##     compW2P (peer)     3.473       NA                           NA       NA
##     poltW2P   (aa)     0.001       NA                           NA       NA
##   agree3 =~
##     compW3S            1.000                                 1.000    1.000
##     poltW3S    (a)     0.000       NA                           NA       NA
##     compW3P (peer)     3.473       NA                           NA       NA
##     poltW3P   (aa)     0.001       NA                           NA       NA
##   agree4 =~
##     compW4S            1.000                                 1.000    1.000
##     poltW4S    (a)     0.000       NA                           NA       NA
##     compW4P (peer)     3.473       NA                           NA       NA
##     poltW4P   (aa)     0.001       NA                           NA       NA
##   interc =~
##     agree1             1.000                                 1.000    1.000
##     agree2             1.000                                 1.000    1.000
##     agree3             1.000                                 1.000    1.000
##     agree4             1.000                                 1.000    1.000
##   slope =~
##     agree1             0.000                                 0.000    0.000
##     agree2             6.000                                 6.000    6.000
##     agree3            13.000                                13.000   13.000
##     agree4            19.000                                19.000   19.000
##    Std.lv  Std.all
##
##     8.042   17.183
##     0.004    0.007
##    27.933   47.495
##     0.008    0.013
##
##     7.818   16.238
##     0.004    0.007
##    27.153   47.424
##     0.008    0.013
##
##     8.068   16.853
##     0.004    0.007
##    28.023   50.664
##     0.008    0.012
##
```

```
##       8.725     17.943
##       0.004      0.007
##      30.306     51.837
##       0.008      0.013
##
##       0.862      0.862
##       0.887      0.887
##       0.859      0.859
##       0.794      0.794
##
##       0.000      0.000
##       0.117      0.117
##       0.246      0.246
##       0.332      0.332
##
## Covariances:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope              0.347       NA                         NA       NA
##   .compaW1S ~~
##     .compaW2S        -49.981       NA                         NA       NA
##     .compaW3S        -52.417       NA                         NA       NA
##     .compaW4S        -54.493       NA                         NA       NA
##     .compaW1P       -224.559       NA                         NA       NA
##     .compaW2P       -173.992       NA                         NA       NA
##     .compaW3P       -182.425       NA                         NA       NA
##     .compaW4P       -189.676       NA                         NA       NA
##   .compaW2S ~~
##     .compaW3S        -56.265       NA                         NA       NA
##     .compaW4S        -59.181       NA                         NA       NA
##   .compaW1P ~~
##     .compaW2S       -174.003       NA                         NA       NA
##   .compaW2S ~~
##     .compaW2P       -212.197       NA                         NA       NA
##     .compaW3P       -195.953       NA                         NA       NA
##     .compaW4P       -206.088       NA                         NA       NA
##   .compaW3S ~~
##     .compaW4S        -64.681       NA                         NA       NA
##   .compaW1P ~~
##     .compaW3S       -182.448       NA                         NA       NA
##   .compaW2P ~~
##     .compaW3S       -195.975       NA                         NA       NA
##   .compaW3S ~~
##     .compaW3P       -226.012       NA                         NA       NA
##     .compaW4P       -225.281       NA                         NA       NA
##   .compaW1P ~~
##     .compaW4S       -189.683       NA                         NA       NA
##   .compaW2P ~~
##     .compaW4S       -206.106       NA                         NA       NA
##   .compaW3P ~~
##     .compaW4S       -225.256       NA                         NA       NA
##   .compaW4S ~~
##     .compaW4P       -264.350       NA                         NA       NA
##   .politW1S ~~
```

```
##     .politW2S         0.214       NA                     NA       NA
##     .politW3S         0.199       NA                     NA       NA
##     .politW4S         0.199       NA                     NA       NA
##     .politW1P         0.163       NA                     NA       NA
##     .politW2P         0.124       NA                     NA       NA
##     .politW3P         0.126       NA                     NA       NA
##     .politW4P         0.136       NA                     NA       NA
##  .politW2S ~~
##     .politW3S         0.237       NA                     NA       NA
##     .politW4S         0.224       NA                     NA       NA
##  .politW1P ~~
##     .politW2S         0.149       NA                     NA       NA
##  .politW2S ~~
##     .politW2P         0.134       NA                     NA       NA
##     .politW3P         0.103       NA                     NA       NA
##     .politW4P         0.126       NA                     NA       NA
##  .politW3S ~~
##     .politW4S         0.255       NA                     NA       NA
##  .politW1P ~~
##     .politW3S         0.156       NA                     NA       NA
##  .politW2P ~~
##     .politW3S         0.136       NA                     NA       NA
##  .politW3S ~~
##     .politW3P         0.122       NA                     NA       NA
##     .politW4P         0.131       NA                     NA       NA
##  .politW1P ~~
##     .politW4S         0.159       NA                     NA       NA
##  .politW2P ~~
##     .politW4S         0.150       NA                     NA       NA
##  .politW3P ~~
##     .politW4S         0.136       NA                     NA       NA
##  .politW4S ~~
##     .politW4P         0.159       NA                     NA       NA
##  .compaW1P ~~
##     .compaW2P      -604.494       NA                     NA       NA
##     .compaW3P      -633.747       NA                     NA       NA
##     .compaW4P      -658.848       NA                     NA       NA
##  .compaW2P ~~
##     .compaW3P      -680.701       NA                     NA       NA
##     .compaW4P      -715.888       NA                     NA       NA
##  .compaW3P ~~
##     .compaW4P      -782.428       NA                     NA       NA
##  .politW1P ~~
##     .politW2P         0.246       NA                     NA       NA
##     .politW3P         0.246       NA                     NA       NA
##     .politW4P         0.266       NA                     NA       NA
##  .politW2P ~~
##     .politW3P         0.270       NA                     NA       NA
##     .politW4P         0.274       NA                     NA       NA
##  .politW3P ~~
##     .politW4P         0.334       NA                     NA       NA
##    Std.lv  Std.all
##
##     0.328    0.328
```

```
##
##    -49.981    -0.798
##    -52.417    -0.811
##    -54.493    -0.779
##   -224.559    -1.002
##   -173.992    -0.798
##   -182.425    -0.811
##   -189.676    -0.780
##
##    -56.265    -0.895
##    -59.181    -0.871
##
##   -174.003    -0.799
##
##   -212.197    -1.002
##   -195.953    -0.896
##   -206.088    -0.872
##
##    -64.681    -0.922
##
##   -182.448    -0.811
##
##   -195.975    -0.896
##
##   -226.012    -1.002
##   -225.281    -0.923
##
##   -189.683    -0.780
##
##   -206.106    -0.872
##
##   -225.256    -0.923
##
##   -264.350    -1.001
##
##      0.214     0.749
##      0.199     0.678
##      0.199     0.688
##      0.163     0.508
##      0.124     0.416
##      0.126     0.373
##      0.136     0.403
##
##      0.237     0.803
##      0.224     0.770
##
##      0.149     0.463
##
##      0.134     0.448
##      0.103     0.302
##      0.126     0.373
##
##      0.255     0.856
##
```

```
##     0.156      0.473
##
##     0.136      0.443
##
##     0.122      0.348
##     0.131      0.378
##
##     0.159      0.488
##
##     0.150      0.496
##
##     0.136      0.395
##
##     0.159      0.466
##
##  -604.494     -0.797
##  -633.747     -0.810
##  -658.848     -0.779
##
##  -680.701     -0.895
##  -715.888     -0.870
##
##  -782.428     -0.922
##
##     0.246      0.734
##     0.246      0.645
##     0.266      0.704
##
##     0.270      0.761
##     0.274      0.777
##
##     0.334      0.835
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      interc          4.139      NA                         NA       NA
##      slope           0.000      NA                         NA       NA
##    .compaW1S          0.000                             0.000    0.000
##    .compaW2S          0.000                             0.000    0.000
##    .compaW3S          0.000                             0.000    0.000
##    .compaW4S          0.000                             0.000    0.000
##    .politW1S   (b)    3.717      NA                         NA       NA
##    .politW2S   (b)    3.717      NA                         NA       NA
##    .politW3S   (b)    3.717      NA                         NA       NA
##    .politW4S   (b)    3.717      NA                         NA       NA
##    .compaW1P   (c)  -10.427      NA                         NA       NA
##    .compaW2P   (c)  -10.427      NA                         NA       NA
##    .compaW3P   (c)  -10.427      NA                         NA       NA
##    .compaW4P   (c)  -10.427      NA                         NA       NA
##    .politW1P   (d)    3.793      NA                         NA       NA
##    .politW2P   (d)    3.793      NA                         NA       NA
##    .politW3P   (d)    3.793      NA                         NA       NA
##    .politW4P   (d)    3.793      NA                         NA       NA
##    .agree1            0.000                             0.000    0.000
```

```
##     .agree2              0.000                           0.000    0.000
##     .agree3              0.000                           0.000    0.000
##     .agree4              0.000                           0.000    0.000
##    Std.lv  Std.all
##     0.597    0.597
##     0.002    0.002
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     3.717    6.969
##     3.717    6.935
##     3.717    6.752
##     3.717    6.863
##   -10.427  -17.729
##   -10.427  -18.211
##   -10.427  -18.852
##   -10.427  -17.836
##     3.793    6.320
##     3.793    6.788
##     3.793    5.977
##     3.793    6.019
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .compaW1S      -64.457       NA                         NA       NA
##     .politW1S        0.285       NA                         NA       NA
##     .compaW1P     -779.931       NA                         NA       NA
##     .politW1P        0.360       NA                         NA       NA
##     .compaW2S      -60.882       NA                         NA       NA
##     .politW2S        0.287       NA                         NA       NA
##     .compaW2P     -736.980       NA                         NA       NA
##     .politW2P        0.312       NA                         NA       NA
##     .compaW3S      -64.862       NA                         NA       NA
##     .politW3S        0.303       NA                         NA       NA
##     .compaW3P     -784.980       NA                         NA       NA
##     .politW3P        0.403       NA                         NA       NA
##     .compaW4S      -75.890       NA                         NA       NA
##     .politW4S        0.293       NA                         NA       NA
##     .compaW4P     -918.087       NA                         NA       NA
##     .politW4P        0.397       NA                         NA       NA
##     .agree1         16.634       NA                         NA       NA
##     .agree2          8.075       NA                         NA       NA
##     .agree3          4.107       NA                         NA       NA
##     .agree4          6.521       NA                         NA       NA
##      interc         48.042       NA                         NA       NA
##      slope           0.023       NA                         NA       NA
##    Std.lv  Std.all
##   -64.457  -294.266
##     0.285    1.000
```

```
## -779.931 -2254.742
## 0.360 1.000
## -60.882 -262.683
## 0.287 1.000
## -736.980 -2248.046
## 0.312 1.000
## -64.862 -283.012
## 0.303 1.000
## -784.980 -2565.888
## 0.403 1.000
## -75.890 -320.960
## 0.293 1.000
## -918.087 -2686.068
## 0.397 1.000
## 0.257 0.257
## 0.132 0.132
## 0.063 0.063
## 0.086 0.086
## 1.000 1.000
## 1.000 1.000
```

```
semPaths(lgmAgree, what = "col", whatLabels = "est", intercepts = T)
```
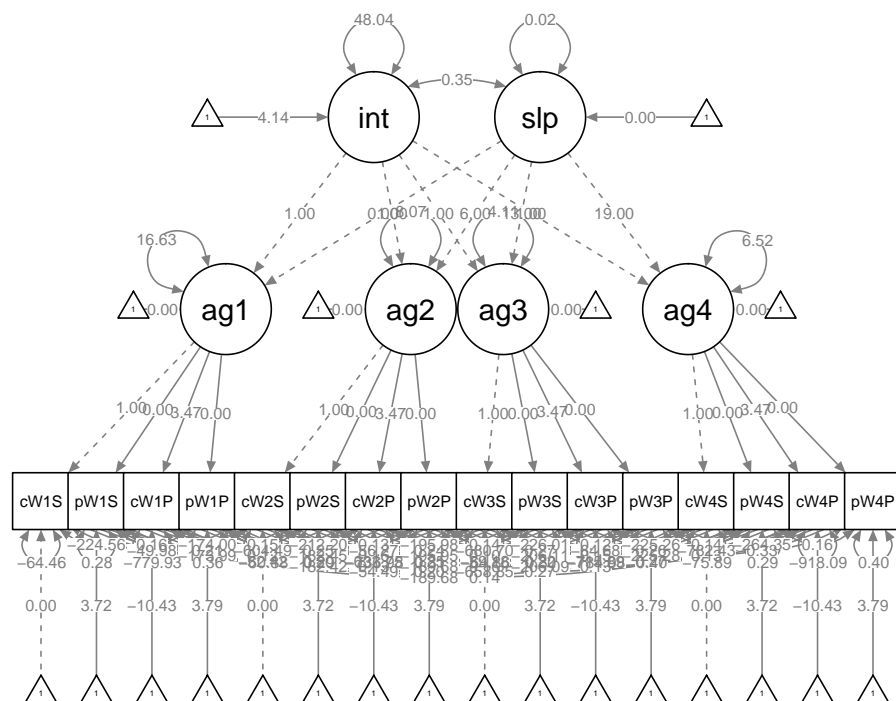

with random parcels

```
lgmAgree <- '

# factor at each time point with same loading
agree1 =~ agreeW1S1         + a * agreeW1S2 +
          peer * agreeW1P1 + aa * agreeW1P2

agree2 =~ agreeW2S1          + a * agreeW2S2 +
          peer * agreeW2P1 + aa * agreeW2P2

agree3 =~ agreeW3S1          + a * agreeW3S2 +
          peer * agreeW3P1 + aa * agreeW3P2

agree4 =~ agreeW4S1          + a * agreeW4S2 +
          peer * agreeW4P1 + aa * agreeW4P2

# second order factor for intercept and slope
interc =~ 1*agree1 + 1*agree2 + 1*agree3 + 1*agree4
slope =~ 0*agree1 + 6*agree2 + 13*agree3 + 19*agree4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
agreeW1S1 ~ 0*1
agreeW2S1 ~ 0*1
agreeW3S1 ~ 0*1
agreeW4S1 ~ 0*1

# fix equal intercepts
agreeW1S2 ~ b*1
agreeW2S2 ~ b*1
agreeW3S2 ~ b*1
agreeW4S2 ~ b*1

agreeW1P1 ~ c*1
agreeW2P1 ~ c*1
agreeW3P1 ~ c*1
agreeW4P1 ~ c*1

agreeW1P2 ~ d*1
agreeW2P2 ~ d*1
agreeW3P2 ~ d*1
agreeW4P2 ~ d*1

# error covariance - similar parcels across waves
agreeW1S1 ~~ agreeW2S1 + agreeW3S1 + agreeW4S1
agreeW2S1 ~~ agreeW3S1 + agreeW4S1
agreeW3S1 ~~ agreeW4S1

agreeW1S2 ~~ agreeW2S2 + agreeW3S2 + agreeW4S2
agreeW2S2 ~~ agreeW3S2 + agreeW4S2
agreeW3S2 ~~ agreeW4S2
```

```
agreeW1P1 ~~ agreeW2P1 + agreeW3P1 + agreeW4P1
agreeW2P1 ~~ agreeW3P1 + agreeW4P1
agreeW3P1 ~~ agreeW4P1

agreeW1P2 ~~ agreeW2P2 + agreeW3P2 + agreeW4P2
agreeW2P2 ~~ agreeW3P2 + agreeW4P2
agreeW3P2 ~~ agreeW4P2

# error covariance - same method at one wave
agreeW1S1 ~~ agreeW1S2
agreeW1P1 ~~ agreeW1P2
agreeW2S1 ~~ agreeW2S2
agreeW2P1 ~~ agreeW2P2
agreeW3S1 ~~ agreeW3S2
agreeW3P1 ~~ agreeW3P2
agreeW4S1 ~~ agreeW4S2
agreeW4P1 ~~ agreeW4P2
'
lgmAgree <- sem(lgmAgree, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!
```

```
summary(lgmAgree, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 did NOT end normally after 314 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA

## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge

##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
```

```
##    Observed information based on              Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   agree1 =~
##     agrW1S1            1.000                                1.000     1.000
##     agrW1S2    (a)     0.948       NA                          NA        NA
##     agrW1P1 (peer)     0.935       NA                          NA        NA
##     agrW1P2   (aa)     0.930       NA                          NA        NA
##   agree2 =~
##     agrW2S1            1.000                                1.000     1.000
##     agrW2S2    (a)     0.948       NA                          NA        NA
##     agrW2P1 (peer)     0.935       NA                          NA        NA
##     agrW2P2   (aa)     0.930       NA                          NA        NA
##   agree3 =~
##     agrW3S1            1.000                                1.000     1.000
##     agrW3S2    (a)     0.948       NA                          NA        NA
##     agrW3P1 (peer)     0.935       NA                          NA        NA
##     agrW3P2   (aa)     0.930       NA                          NA        NA
##   agree4 =~
##     agrW4S1            1.000                                1.000     1.000
##     agrW4S2    (a)     0.948       NA                          NA        NA
##     agrW4P1 (peer)     0.935       NA                          NA        NA
##     agrW4P2   (aa)     0.930       NA                          NA        NA
##   interc =~
##     agree1             1.000                                1.000     1.000
##     agree2             1.000                                1.000     1.000
##     agree3             1.000                                1.000     1.000
##     agree4             1.000                                1.000     1.000
##   slope =~
##     agree1             0.000                                0.000     0.000
##     agree2             6.000                                6.000     6.000
##     agree3            13.000                               13.000    13.000
##     agree4            19.000                               19.000    19.000
##    Std.lv  Std.all
##
##    1.348    0.949
##    1.278    0.946
##    1.261    0.967
##    1.253    0.972
##
##    1.259    0.954
##    1.193    0.953
##    1.177    0.920
##    1.170    0.940
##
##    1.262    0.945
##    1.196    0.943
##    1.180    0.900
##    1.173    0.947
##
##    1.324    0.949
##    1.255    0.945
##    1.238    0.925
```

30

```
##     1.231    0.961
##
##     0.863    0.863
##     0.925    0.925
##     0.922    0.922
##     0.879    0.879
##
##        NA       NA
##        NA       NA
##        NA       NA
##        NA       NA
##
## Covariances:
##                 Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope          0.014       NA                        NA       NA
##  .agreeW1S1 ~~
##    .agreeW2S1      0.086       NA                        NA       NA
##    .agreeW3S1      0.065       NA                        NA       NA
##    .agreeW4S1      0.019       NA                        NA       NA
##  .agreeW2S1 ~~
##    .agreeW3S1      0.087       NA                        NA       NA
##    .agreeW4S1      0.094       NA                        NA       NA
##  .agreeW3S1 ~~
##    .agreeW4S1      0.065       NA                        NA       NA
##  .agreeW1S2 ~~
##    .agreeW2S2      0.083       NA                        NA       NA
##    .agreeW3S2      0.063       NA                        NA       NA
##    .agreeW4S2      0.040       NA                        NA       NA
##  .agreeW2S2 ~~
##    .agreeW3S2      0.090       NA                        NA       NA
##    .agreeW4S2      0.065       NA                        NA       NA
##  .agreeW3S2 ~~
##    .agreeW4S2      0.036       NA                        NA       NA
##  .agreeW1P1 ~~
##    .agreeW2P1      0.050       NA                        NA       NA
##    .agreeW3P1      0.056       NA                        NA       NA
##    .agreeW4P1      0.047       NA                        NA       NA
##  .agreeW2P1 ~~
##    .agreeW3P1      0.219       NA                        NA       NA
##    .agreeW4P1      0.208       NA                        NA       NA
##  .agreeW3P1 ~~
##    .agreeW4P1      0.245       NA                        NA       NA
##  .agreeW1P2 ~~
##    .agreeW2P2      0.144       NA                        NA       NA
##    .agreeW3P2      0.132       NA                        NA       NA
##    .agreeW4P2      0.124       NA                        NA       NA
##  .agreeW2P2 ~~
##    .agreeW3P2      0.169       NA                        NA       NA
##    .agreeW4P2      0.156       NA                        NA       NA
##  .agreeW3P2 ~~
##    .agreeW4P2      0.144       NA                        NA       NA
##  .agreeW1S1 ~~
##    .agreeW1S2      0.097       NA                        NA       NA
```

```
## .agreeW1P1 ~~
##     .agreeW1P2          -0.000      NA                      NA       NA
## .agreeW2S1 ~~
##     .agreeW2S2          -0.022      NA                      NA       NA
## .agreeW2P1 ~~
##     .agreeW2P2          -0.000      NA                      NA       NA
## .agreeW3S1 ~~
##     .agreeW3S2           0.094      NA                      NA       NA
## .agreeW3P1 ~~
##     .agreeW3P2          -0.000      NA                      NA       NA
## .agreeW4S1 ~~
##     .agreeW4S2           0.121      NA                      NA       NA
## .agreeW4P1 ~~
##     .agreeW4P2          -0.000      NA                      NA       NA
##    Std.lv  Std.all
##
##     0.509    0.509
##
##     0.086    0.489
##     0.065    0.332
##     0.019    0.099
##
##     0.087    0.502
##     0.094    0.541
##
##     0.065    0.336
##
##     0.083    0.500
##     0.063    0.339
##     0.040    0.212
##
##     0.090    0.554
##     0.065    0.391
##
##     0.036    0.197
##
##     0.050    0.300
##     0.056    0.298
##     0.047    0.281
##
##     0.219    0.763
##     0.208    0.818
##
##     0.245    0.843
##
##     0.144    1.119
##     0.132    1.093
##     0.124    1.155
##
##     0.169    1.004
##     0.156    1.043
##
##     0.144    1.027
##
```

```
##     0.097    0.498
##
##    -0.000   -0.003
##
##    -0.022   -0.143
##
##    -0.000   -0.000
##
##     0.094    0.509
##
##    -0.000   -0.000
##
##     0.121    0.629
##
##    -0.000   -0.001
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##      interc          3.712       NA                          NA        NA
##      slope          -0.000       NA                          NA        NA
##     .agreeW1S1        0.000                              0.000     0.000
##     .agreeW2S1        0.000                              0.000     0.000
##     .agreeW3S1        0.000                              0.000     0.000
##     .agreeW4S1        0.000                              0.000     0.000
##     .agreeW1S2  (b)   0.278       NA                          NA        NA
##     .agreeW2S2  (b)   0.278       NA                          NA        NA
##     .agreeW3S2  (b)   0.278       NA                          NA        NA
##     .agreeW4S2  (b)   0.278       NA                          NA        NA
##     .agreeW1P1  (c)   0.137       NA                          NA        NA
##     .agreeW2P1  (c)   0.137       NA                          NA        NA
##     .agreeW3P1  (c)   0.137       NA                          NA        NA
##     .agreeW4P1  (c)   0.137       NA                          NA        NA
##     .agreeW1P2  (d)   0.327       NA                          NA        NA
##     .agreeW2P2  (d)   0.327       NA                          NA        NA
##     .agreeW3P2  (d)   0.327       NA                          NA        NA
##     .agreeW4P2  (d)   0.327       NA                          NA        NA
##     .agree1           0.000                              0.000     0.000
##     .agree2           0.000                              0.000     0.000
##     .agree3           0.000                              0.000     0.000
##     .agree4           0.000                              0.000     0.000
##    Std.lv  Std.all
##     3.190    3.190
##        NA       NA
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.278    0.206
##     0.278    0.222
##     0.278    0.219
##     0.278    0.210
##     0.137    0.105
##     0.137    0.107
##     0.137    0.105
```

```
##      0.137     0.103
##      0.327     0.254
##      0.327     0.263
##      0.327     0.264
##      0.327     0.256
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .agreeW1S1       0.199       NA                          NA       NA
##     .agreeW1S2       0.191       NA                          NA       NA
##     .agreeW1P1       0.109       NA                          NA       NA
##     .agreeW1P2       0.092       NA                          NA       NA
##     .agreeW2S1       0.156       NA                          NA       NA
##     .agreeW2S2       0.145       NA                          NA       NA
##     .agreeW2P1       0.251       NA                          NA       NA
##     .agreeW2P2       0.180       NA                          NA       NA
##     .agreeW3S1       0.192       NA                          NA       NA
##     .agreeW3S2       0.180       NA                          NA       NA
##     .agreeW3P1       0.327       NA                          NA       NA
##     .agreeW3P2       0.158       NA                          NA       NA
##     .agreeW4S1       0.194       NA                          NA       NA
##     .agreeW4S2       0.190       NA                          NA       NA
##     .agreeW4P1       0.258       NA                          NA       NA
##     .agreeW4P2       0.124       NA                          NA       NA
##     .agree1          0.462       NA                          NA       NA
##     .agree2          0.082       NA                          NA       NA
##     .agree3         -0.032       NA                          NA       NA
##     .agree4          0.067       NA                          NA       NA
##      interc          1.355       NA                          NA       NA
##      slope          -0.001       NA                          NA       NA
##    Std.lv  Std.all
##     0.199    0.099
##     0.191    0.105
##     0.109    0.064
##     0.092    0.056
##     0.156    0.090
##     0.145    0.093
##     0.251    0.153
##     0.180    0.116
##     0.192    0.107
##     0.180    0.112
##     0.327    0.190
##     0.158    0.103
##     0.194    0.100
##     0.190    0.107
##     0.258    0.144
##     0.124    0.076
##     0.254    0.254
##     0.052    0.052
##    -0.020   -0.020
```

```
##      0.038    0.038
##      1.000    1.000
##         NA       NA
```

```
semPaths(lgmAgree, what = "col", whatLabels = "est", intercepts = T)
```
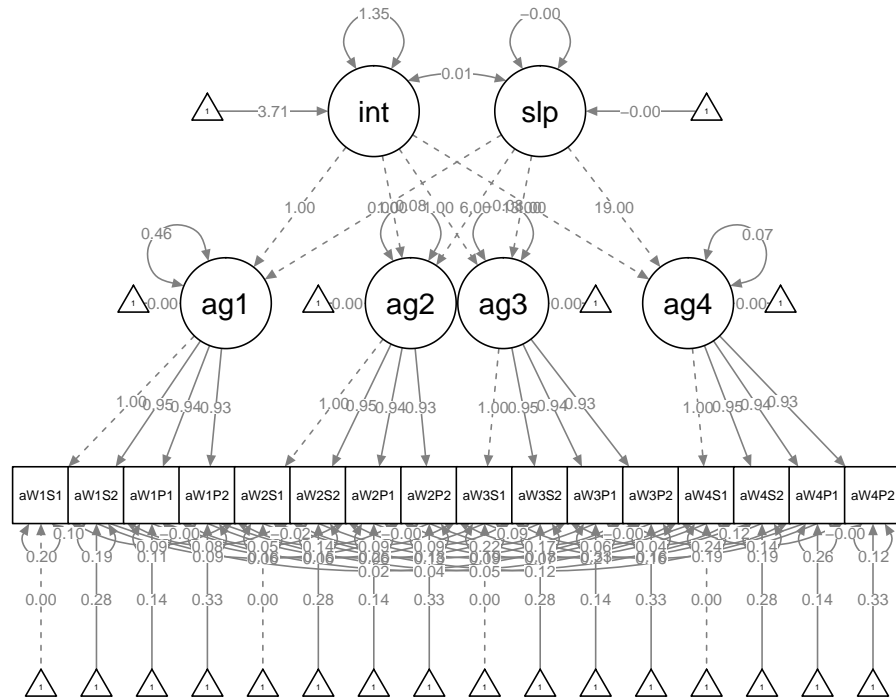

parcelAllocation

```
item.syntax <- c(paste0("f1 =~ w1bf_", c(2,12,22,32,42,52,62,72,82,92,
                                         7,17,27,37,47,57,67,77,87,97)),
                 paste0("f1 =~ pw1bf_", c(2,12,22,32,42,52,62,72,82,92,
                                         7,17,27,37,47,57,67,77,87,97)),
                 paste0("f2 =~ w2bf_", c(2,12,22,32,42,52,62,72,82,92,
                                         7,17,27,37,47,57,67,77,87,97)),
                 paste0("f2 =~ pw2bf_", c(2,12,22,32,42,52,62,72,82,92,
                                         7,17,27,37,47,57,67,77,87,97)),
                 paste0("f3 =~ w3bf_", c(2,12,22,32,42,52,62,72,82,92,
                                         7,17,27,37,47,57,67,77,87,97)),
                 paste0("f3 =~ pw3bf_", c(2,12,22,32,42,52,62,72,82,92,
                                         7,17,27,37,47,57,67,77,87,97)),
                 paste0("f4 =~ w4bf_", c(2,12,22,32,42,52,62,72,82,92,
                                         7,17,27,37,47,57,67,77,87,97)),
                 paste0("f4 =~ pw4bf_", c(2,12,22,32,42,52,62,72,82,92,
                                         7,17,27,37,47,57,67,77,87,97)))
mod.parcels <- '
f1 =~ par1 + par2 + par3 + par4
```

```
f2 =~ par5 + par6 + par7 + par8
f3 =~ par9 + par10 + par11 + par12
f4 =~ par13 + par14 + par15 + par16
'

parcel.names <- paste0("par", 1:16)

parcelAllocation(mod.parcels, data = data, nAlloc = 100,
                 parcel.names = parcel.names, item.syntax = item.syntax,
                 std.lv = TRUE)
```

```
## Error in parcelAllocation(mod.parcels, data = data, nAlloc = 100, parcel.names = parcel.names, : coul
```

```
dataList <- parcelAllocation(mod.parcels, data = data, nAlloc = 100,
                             parcel.names = parcel.names,
                             item.syntax = item.syntax)
```

```
## Error in parcelAllocation(mod.parcels, data = data, nAlloc = 100, parcel.names = parcel.names, : coul
```

with latent method factors

```
lgmAgree <- '
# factor at each time point with same loading
agree1 =~ agreeW1S1       + a * agreeW1S2 +
          peer * agreeW1P1 + aa * agreeW1P2

agree2 =~ agreeW2S1       + a * agreeW2S2 +
          peer * agreeW2P1 + aa * agreeW2P2

agree3 =~ agreeW3S1       + a * agreeW3S2 +
          peer * agreeW3P1 + aa * agreeW3P2

agree4 =~ agreeW4S1       + a * agreeW4S2 +
          peer * agreeW4P1 + aa * agreeW4P2

# second order factor for intercept and slope
interc =~ 1*agree1 + 1*agree2 + 1*agree3 + 1*agree4
slope =~ 0*agree1 + 6*agree2 + 13*agree3 + 19*agree4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
agreeW1S1 ~ 0*1
agreeW2S1 ~ 0*1
agreeW3S1 ~ 0*1
agreeW4S1 ~ 0*1

# fix equal intercepts
agreeW1S2 ~ b*1
agreeW2S2 ~ b*1
agreeW3S2 ~ b*1
agreeW4S2 ~ b*1
```

```
agreeW1P1 ~ c*1
agreeW2P1 ~ c*1
agreeW3P1 ~ c*1
agreeW4P1 ~ c*1

agreeW1P2 ~ d*1
agreeW2P2 ~ d*1
agreeW3P2 ~ d*1
agreeW4P2 ~ d*1

# latent method variances
self =~ agreeW1S1 + agreeW1S2 +
        agreeW2S1 + agreeW2S2 +
        agreeW3S1 + agreeW3S2 +
        agreeW4S1 + agreeW4S2
peer =~ agreeW1P1 + agreeW1P2 +
        agreeW2P1 + agreeW2P2 +
        agreeW3P1 + agreeW3P2 +
        agreeW4P1 + agreeW4P2
'
lgmAgree <- sem(lgmAgree, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!
```

```
summary(lgmAgree, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 did NOT end normally after 392 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         70
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA

## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge

##
## Parameter Estimates:
##
```

```
##    Standard errors                              Standard
##    Information                                   Observed
##    Observed information based on                 Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   agree1 =~
##     agrW1S1          1.000                                1.000    1.000
##     agrW1S2    (a)   0.960      NA                           NA       NA
##     agrW1P1 (peer)   0.837      NA                           NA       NA
##     agrW1P2   (aa)   0.803      NA                           NA       NA
##   agree2 =~
##     agrW2S1          1.000                                1.000    1.000
##     agrW2S2    (a)   0.960      NA                           NA       NA
##     agrW2P1 (peer)   0.837      NA                           NA       NA
##     agrW2P2   (aa)   0.803      NA                           NA       NA
##   agree3 =~
##     agrW3S1          1.000                                1.000    1.000
##     agrW3S2    (a)   0.960      NA                           NA       NA
##     agrW3P1 (peer)   0.837      NA                           NA       NA
##     agrW3P2   (aa)   0.803      NA                           NA       NA
##   agree4 =~
##     agrW4S1          1.000                                1.000    1.000
##     agrW4S2    (a)   0.960      NA                           NA       NA
##     agrW4P1 (peer)   0.837      NA                           NA       NA
##     agrW4P2   (aa)   0.803      NA                           NA       NA
##   interc =~
##     agree1           1.000                                1.000    1.000
##     agree2           1.000                                1.000    1.000
##     agree3           1.000                                1.000    1.000
##     agree4           1.000                                1.000    1.000
##   slope =~
##     agree1           0.000                                0.000    0.000
##     agree2           6.000                                6.000    6.000
##     agree3          13.000                               13.000   13.000
##     agree4          19.000                               19.000   19.000
##   self =~
##     agrW1S1          1.000                                1.000    1.000
##     agrW1S2          0.920      NA                           NA       NA
##     agrW2S1          0.762      NA                           NA       NA
##     agrW2S2          0.806      NA                           NA       NA
##     agrW3S1          0.643      NA                           NA       NA
##     agrW3S2          0.645      NA                           NA       NA
##     agrW4S1          0.398      NA                           NA       NA
##     agrW4S2          0.396      NA                           NA       NA
##   peer =~
##     agrW1P1          1.000                                1.000    1.000
##     agrW1P2          1.180      NA                           NA       NA
##     agrW2P1          0.730      NA                           NA       NA
##     agrW2P2          1.147      NA                           NA       NA
##     agrW3P1          0.601      NA                           NA       NA
##     agrW3P2          1.100      NA                           NA       NA
##     agrW4P1          0.577      NA                           NA       NA
##     agrW4P2          1.063      NA                           NA       NA
```

```
##      Std.lv  Std.all
##
##      1.069   0.840
##      1.026   0.840
##      0.895   0.538
##      0.859   0.476
##
##      1.080   0.886
##      1.037   0.859
##      0.904   0.608
##      0.868   0.482
##
##      1.096   0.877
##      1.051   0.868
##      0.917   0.656
##      0.880   0.491
##
##      1.111   0.939
##      1.066   0.935
##      0.930   0.678
##      0.892   0.500
##
##      1.000   1.000
##      0.990   0.990
##      0.976   0.976
##      0.962   0.962
##
##      0.000   0.000
##      0.044   0.044
##      0.093   0.093
##      0.134   0.134
##
##      0.790   0.621
##      0.727   0.595
##      0.602   0.494
##      0.637   0.528
##      0.508   0.406
##      0.510   0.421
##      0.315   0.266
##      0.313   0.274
##
##      1.133   0.681
##      1.337   0.741
##      0.827   0.556
##      1.299   0.721
##      0.681   0.487
##      1.247   0.696
##      0.654   0.477
##      1.204   0.675
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope            0.002      NA                         NA       NA
```

```
##      self            -0.089     NA                      NA       NA
##      peer             0.383     NA                      NA       NA
##   slope ~~
##      self             0.005     NA                      NA       NA
##      peer             0.009     NA                      NA       NA
##   self ~~
##      peer             0.725     NA                      NA       NA
##    Std.lv  Std.all
##
##    0.216   0.216
##   -0.106  -0.106
##    0.316   0.316
##
##    0.856   0.856
##    0.989   0.989
##
##    0.810   0.810
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      interc          3.321     NA                      NA       NA
##      slope           0.001     NA                      NA       NA
##   .agreeW1S1         0.000                           0.000    0.000
##   .agreeW2S1         0.000                           0.000    0.000
##   .agreeW3S1         0.000                           0.000    0.000
##   .agreeW4S1         0.000                           0.000    0.000
##   .agreeW1S2   (b)   0.278     NA                      NA       NA
##   .agreeW2S2   (b)   0.278     NA                      NA       NA
##   .agreeW3S2   (b)   0.278     NA                      NA       NA
##   .agreeW4S2   (b)   0.278     NA                      NA       NA
##   .agreeW1P1   (c)   0.265     NA                      NA       NA
##   .agreeW2P1   (c)   0.265     NA                      NA       NA
##   .agreeW3P1   (c)   0.265     NA                      NA       NA
##   .agreeW4P1   (c)   0.265     NA                      NA       NA
##   .agreeW1P2   (d)   0.409     NA                      NA       NA
##   .agreeW2P2   (d)   0.409     NA                      NA       NA
##   .agreeW3P2   (d)   0.409     NA                      NA       NA
##   .agreeW4P2   (d)   0.409     NA                      NA       NA
##   .agree1            0.000                           0.000    0.000
##   .agree2            0.000                           0.000    0.000
##   .agree3            0.000                           0.000    0.000
##   .agree4            0.000                           0.000    0.000
##      self            0.000                           0.000    0.000
##      peer            0.000                           0.000    0.000
##    Std.lv  Std.all
##    3.107   3.107
##    0.076   0.076
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##    0.278   0.228
##    0.278   0.231
##    0.278   0.230
```

```
##     0.278    0.244
##     0.265    0.159
##     0.265    0.178
##     0.265    0.190
##     0.265    0.194
##     0.409    0.227
##     0.409    0.227
##     0.409    0.228
##     0.409    0.229
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .agreeW1S1        0.029       NA                         NA       NA
##    .agreeW1S2        0.070       NA                         NA       NA
##    .agreeW1P1        0.045       NA                         NA       NA
##    .agreeW1P2       -0.000       NA                         NA       NA
##    .agreeW2S1        0.044       NA                         NA       NA
##    .agreeW2S2        0.064       NA                         NA       NA
##    .agreeW2P1        0.180       NA                         NA       NA
##    .agreeW2P2       -0.000       NA                         NA       NA
##    .agreeW3S1        0.129       NA                         NA       NA
##    .agreeW3S2        0.127       NA                         NA       NA
##    .agreeW3P1        0.150       NA                         NA       NA
##    .agreeW3P2        0.000       NA                         NA       NA
##    .agreeW4S1        0.056       NA                         NA       NA
##    .agreeW4S2        0.056       NA                         NA       NA
##    .agreeW4P1        0.055       NA                         NA       NA
##    .agreeW4P2       -0.000       NA                         NA       NA
##    .agree1           0.000       NA                         NA       NA
##    .agree2           0.000       NA                         NA       NA
##    .agree3          -0.000       NA                         NA       NA
##    .agree4           0.000       NA                         NA       NA
##     interc           1.143       NA                         NA       NA
##     slope            0.000       NA                         NA       NA
##     self             0.624       NA                         NA       NA
##     peer             1.283       NA                         NA       NA
##    Std.lv  Std.all
##     0.029    0.018
##     0.070    0.047
##     0.045    0.016
##    -0.000   -0.000
##     0.044    0.029
##     0.064    0.044
##     0.180    0.081
##    -0.000   -0.000
##     0.129    0.083
##     0.127    0.087
##     0.150    0.077
```

```
##      0.000      0.000
##      0.056      0.040
##      0.056      0.043
##      0.055      0.029
##     -0.000     -0.000
##      0.000      0.000
##      0.000      0.000
##     -0.000     -0.000
##      0.000      0.000
##      1.000      1.000
##      1.000      1.000
##      1.000      1.000
##      1.000      1.000
```

```r
semPaths(lgmAgree, what = "col", whatLabels = "est", intercepts = T)
```
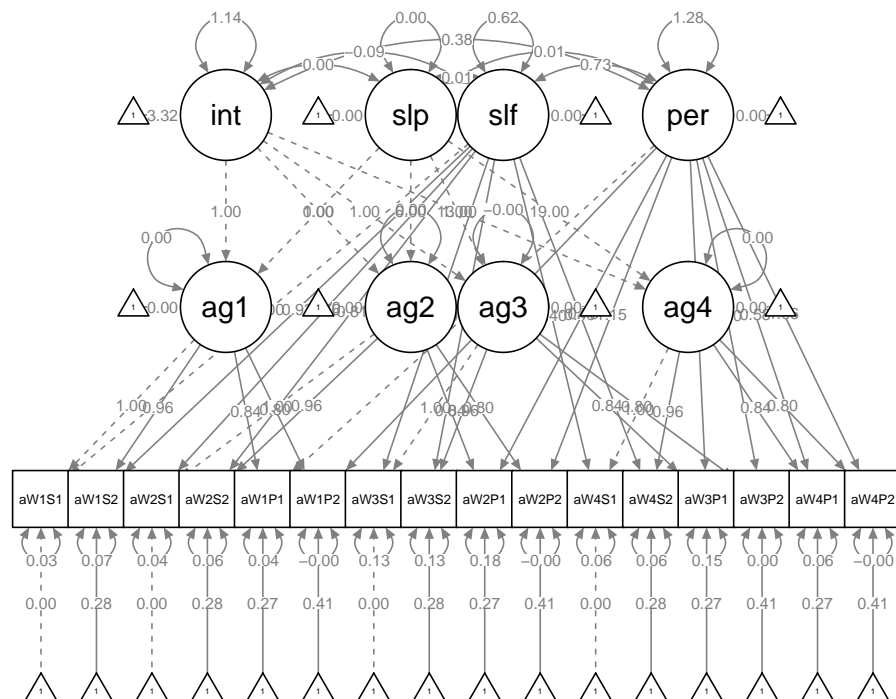

with random parcels + equality and positive constraints in residual covar

```r
lgmAgree <- '

# factor at each time point with same loading
agree1 =~ agreeW1S1        + a * agreeW1S2 +
          peer * agreeW1P1 + aa * agreeW1P2

agree2 =~ agreeW2S1        + a * agreeW2S2 +
          peer * agreeW2P1 + aa * agreeW2P2
```

```
agree3 =~ agreeW3S1        + a * agreeW3S2 +
            peer * agreeW3P1 + aa * agreeW3P2

agree4 =~ agreeW4S1        + a * agreeW4S2 +
            peer * agreeW4P1 + aa * agreeW4P2

# second order factor for intercept and slope
interc =~ 1*agree1 + 1*agree2 + 1*agree3 + 1*agree4
slope =~ 0*agree1 + 6*agree2 + 13*agree3 + 19*agree4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
agreeW1S1 ~ 0*1
agreeW2S1 ~ 0*1
agreeW3S1 ~ 0*1
agreeW4S1 ~ 0*1

# fix equal intercepts
agreeW1S2 ~ b*1
agreeW2S2 ~ b*1
agreeW3S2 ~ b*1
agreeW4S2 ~ b*1

agreeW1P1 ~ c*1
agreeW2P1 ~ c*1
agreeW3P1 ~ c*1
agreeW4P1 ~ c*1

agreeW1P2 ~ d*1
agreeW2P2 ~ d*1
agreeW3P2 ~ d*1
agreeW4P2 ~ d*1

# error covariance - similar parcels across waves
agreeW1S1 ~~ covs1*agreeW2S1 + covs2*agreeW3S1 + covs3*agreeW4S1
agreeW2S1 ~~ covs1*agreeW3S1 + covs2*agreeW4S1
agreeW3S1 ~~ covs1*agreeW4S1

agreeW1S2 ~~ covs1*agreeW2S2 + covs2*agreeW3S2 + covs3*agreeW4S2
agreeW2S2 ~~ covs1*agreeW3S2 + covs2*agreeW4S2
agreeW3S2 ~~ covs1*agreeW4S2

agreeW1P1 ~~ covp1*agreeW2P1 + covp2*agreeW3P1 + covp3*agreeW4P1
agreeW2P1 ~~ covp1*agreeW3P1 + covp2*agreeW4P1
agreeW3P1 ~~ covp1*agreeW4P1

agreeW1P2 ~~ covp1*agreeW2P2 + covp2*agreeW3P2 + covp3*agreeW4P2
agreeW2P2 ~~ covp1*agreeW3P2 + covp2*agreeW4P2
agreeW3P2 ~~ covp1*agreeW4P2

# positive constraints for variances
```

```
agree1 ~~ var1*agree1
agree2 ~~ var2*agree2
agree3 ~~ var3*agree3
agree4 ~~ var4*agree4
interc ~~ var5*interc
slope ~~ var6*slope
var1 > 0
var2 > 0
var3 > 0
var4 > 0
var5 > 0
var6 > 0
agreeW1S1 ~~ var7*agreeW1S1
agreeW2S1 ~~ var8*agreeW2S1
agreeW3S1 ~~ var9*agreeW3S1
agreeW4S1 ~~ var10*agreeW4S1
agreeW1S2 ~~ var11*agreeW1S2
agreeW2S2 ~~ var12*agreeW2S2
agreeW3S2 ~~ var13*agreeW3S2
agreeW4S2 ~~ var14*agreeW4S2
agreeW1P1 ~~ var15*agreeW1P1
agreeW2P1 ~~ var16*agreeW2P1
agreeW3P1 ~~ var17*agreeW3P1
agreeW4P1 ~~ var18*agreeW4P1
agreeW1P2 ~~ var19*agreeW1P2
agreeW2P2 ~~ var20*agreeW2P2
agreeW3P2 ~~ var21*agreeW3P2
agreeW4P2 ~~ var22*agreeW4P2
var7 > 0
var8 > 0
var9 > 0
var10 > 0
var11 > 0
var12 > 0
var13 > 0
var14 > 0
var15 > 0
var16 > 0
var17 > 0
var18 > 0
var19 > 0
var20 > 0
var21 > 0
var22 > 0
'
lgmAgree <- sem(lgmAgree, data = data, missing = "ML")
```

Warning in computeOmega(Sigma.hat = Sigma.hat, Mu.hat = Mu.hat, lavsamplestats = lavsamplestats, : l

Warning in computeOmega(Sigma.hat = Sigma.hat, Mu.hat = Mu.hat, lavsamplestats = lavsamplestats, : l

Error in chol.default(S): the leading minor of order 3 is not positive definite

```r
summary(lgmAgree, fit.measures = T, standardized = T, ci = T)
```

```
##     Length     Class      Mode
##          1 character character
```

```r
semPaths(lgmAgree, what = "col", whatLabels = "est", intercepts = T)
```

```
## Error in semPlotModel.default("\n\n# factor at each time point with same loading\nagree1 =~ agreeW1S:
```

LGM Conscientiousness

with aspects as parcels

```r
lgmConsci <- '

# factor at each time point with same loading
consci1 =~ indusW1S        + a * orderW1S +
           peer * indusW1P + aa * orderW1P

consci2 =~ indusW2S        + a * orderW2S +
           peer * indusW2P + aa * orderW2P

consci3 =~ indusW3S        + a * orderW3S +
           peer * indusW3P + aa * orderW3P

consci4 =~ indusW4S        + a * orderW4S +
           peer * indusW4P + aa * orderW4P

# second order factor for intercept and slope
interc =~ 1*consci1 + 1*consci2 + 1*consci3 + 1*consci4
slope =~ 0*consci1 + 6*consci2 + 13*consci3 + 19*consci4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
indusW1S ~ 0*1
indusW2S ~ 0*1
indusW3S ~ 0*1
indusW4S ~ 0*1

# fix equal intercepts
orderW1S ~ b*1
orderW2S ~ b*1
orderW3S ~ b*1
orderW4S ~ b*1

indusW1P ~ c*1
indusW2P ~ c*1
indusW3P ~ c*1
indusW4P ~ c*1

orderW1P ~ d*1
orderW2P ~ d*1
```

```
orderW3P ~ d*1
orderW4P ~ d*1

# error covariance - similar aspects across waves and informants
indusW1S ~~ indusW2S + indusW3S + indusW4S +
           indusW1P + indusW2P + indusW3P + indusW4P
indusW2S ~~ indusW3S + indusW4S +
           indusW1P + indusW2P + indusW3P + indusW4P
indusW3S ~~ indusW4S +
           indusW1P + indusW2P + indusW3P + indusW4P
indusW4S ~~ indusW1P + indusW2P + indusW3P + indusW4P


orderW1S ~~ orderW2S + orderW3S + orderW4S +
           orderW1P + orderW2P + orderW3P + orderW4P
orderW2S ~~ orderW3S + orderW4S +
           orderW1P + orderW2P + orderW3P + orderW4P
orderW3S ~~ orderW4S +
           orderW1P + orderW2P + orderW3P + orderW4P
orderW4S ~~ orderW1P + orderW2P + orderW3P + orderW4P


indusW1P ~~ indusW2P + indusW3P + indusW4P
indusW2P ~~ indusW3P + indusW4P
indusW3P ~~ indusW4P


orderW1P ~~ orderW2P + orderW3P + orderW4P
orderW2P ~~ orderW3P + orderW4P
orderW3P ~~ orderW4P
'
lgmConsci <- sem(lgmConsci, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                but not all elements of the gradient are (near) zero;
##                the optimizer may not have found a local solution
##                use check.gradient = FALSE to skip this check.

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                but not all elements of the gradient are (near) zero;
##                the optimizer may not have found a local solution
##                use check.gradient = FALSE to skip this check.

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                but not all elements of the gradient are (near) zero;
##                the optimizer may not have found a local solution
##                use check.gradient = FALSE to skip this check.

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                but not all elements of the gradient are (near) zero;
##                the optimizer may not have found a local solution
##                use check.gradient = FALSE to skip this check.
```

```
summary(lgmConsci, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 did NOT end normally after 388 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
```

```
##    Optimization method                        NLMINB
##    Number of free parameters                      105
##    Number of equality constraints                  18
##
##    Number of observations                         259
##    Number of missing patterns                      51
##
## Model Test User Model:
##
##    Test statistic                                  NA
##    Degrees of freedom                              NA

## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge

##
## Parameter Estimates:
##
##    Standard errors                          Standard
##    Information                              Observed
##    Observed information based on             Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   consci1 =~
##     indsW1S            1.000                              1.000    1.000
##     ordrW1S    (a)    1.374       NA                         NA       NA
##     indsW1P (peer)    4.988       NA                         NA       NA
##     ordrW1P   (aa)    4.525       NA                         NA       NA
##   consci2 =~
##     indsW2S            1.000                              1.000    1.000
##     ordrW2S    (a)    1.374       NA                         NA       NA
##     indsW2P (peer)    4.988       NA                         NA       NA
##     ordrW2P   (aa)    4.525       NA                         NA       NA
##   consci3 =~
##     indsW3S            1.000                              1.000    1.000
##     ordrW3S    (a)    1.374       NA                         NA       NA
##     indsW3P (peer)    4.988       NA                         NA       NA
##     ordrW3P   (aa)    4.525       NA                         NA       NA
##   consci4 =~
##     indsW4S            1.000                              1.000    1.000
##     ordrW4S    (a)    1.374       NA                         NA       NA
##     indsW4P (peer)    4.988       NA                         NA       NA
##     ordrW4P   (aa)    4.525       NA                         NA       NA
##   interc =~
##     consci1           1.000                              1.000    1.000
##     consci2           1.000                              1.000    1.000
##     consci3           1.000                              1.000    1.000
##     consci4           1.000                              1.000    1.000
##   slope =~
##     consci1           0.000                              0.000    0.000
##     consci2           6.000                              6.000    6.000
##     consci3          13.000                             13.000   13.000
##     consci4          19.000                             19.000   19.000
##    Std.lv  Std.all
##
```

```
##     0.097    0.163
##     0.134    0.215
##     0.485    0.778
##     0.440    0.685
##
##     0.087    0.140
##     0.119    0.214
##     0.432    0.707
##     0.392    0.679
##
##     0.077    0.131
##     0.105    0.180
##     0.382    0.620
##     0.347    0.549
##
##     0.082    0.137
##     0.112    0.177
##     0.407    0.701
##     0.369    0.601
##
##     0.811    0.811
##     0.912    0.912
##     1.030    1.030
##     0.968    0.968
##
##       NA       NA
##       NA       NA
##       NA       NA
##       NA       NA
##
## Covariances:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope          -0.000       NA                        NA       NA
##   .indusW1S ~~
##     .indusW2S       0.275       NA                        NA       NA
##     .indusW3S       0.235       NA                        NA       NA
##     .indusW4S       0.239       NA                        NA       NA
##     .indusW1P       0.062       NA                        NA       NA
##     .indusW2P       0.086       NA                        NA       NA
##     .indusW3P       0.083       NA                        NA       NA
##     .indusW4P       0.060       NA                        NA       NA
##   .indusW2S ~~
##     .indusW3S       0.285       NA                        NA       NA
##     .indusW4S       0.294       NA                        NA       NA
##   .indusW1P ~~
##     .indusW2S       0.048       NA                        NA       NA
##   .indusW2S ~~
##     .indusW2P       0.101       NA                        NA       NA
##     .indusW3P       0.102       NA                        NA       NA
##     .indusW4P       0.080       NA                        NA       NA
##   .indusW3S ~~
##     .indusW4S       0.291       NA                        NA       NA
##   .indusW1P ~~
```

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```
##      .indusW3S          0.037     NA                          NA      NA
##   .indusW2P ~~
##      .indusW3S          0.091     NA                          NA      NA
##   .indusW3S ~~
##      .indusW3P          0.064     NA                          NA      NA
##      .indusW4P          0.046     NA                          NA      NA
##   .indusW1P ~~
##      .indusW4S          0.066     NA                          NA      NA
##   .indusW2P ~~
##      .indusW4S          0.106     NA                          NA      NA
##   .indusW3P ~~
##      .indusW4S          0.074     NA                          NA      NA
##   .indusW4S ~~
##      .indusW4P          0.063     NA                          NA      NA
##   .orderW1S ~~
##      .orderW2S          0.246     NA                          NA      NA
##      .orderW3S          0.263     NA                          NA      NA
##      .orderW4S          0.247     NA                          NA      NA
##      .orderW1P          0.083     NA                          NA      NA
##      .orderW2P          0.122     NA                          NA      NA
##      .orderW3P          0.093     NA                          NA      NA
##      .orderW4P          0.102     NA                          NA      NA
##   .orderW2S ~~
##      .orderW3S          0.259     NA                          NA      NA
##      .orderW4S          0.255     NA                          NA      NA
##   .orderW1P ~~
##      .orderW2S          0.101     NA                          NA      NA
##   .orderW2S ~~
##      .orderW2P          0.117     NA                          NA      NA
##      .orderW3P          0.098     NA                          NA      NA
##      .orderW4P          0.097     NA                          NA      NA
##   .orderW3S ~~
##      .orderW4S          0.291     NA                          NA      NA
##   .orderW1P ~~
##      .orderW3S          0.096     NA                          NA      NA
##   .orderW2P ~~
##      .orderW3S          0.142     NA                          NA      NA
##   .orderW3S ~~
##      .orderW3P          0.091     NA                          NA      NA
##      .orderW4P          0.106     NA                          NA      NA
##   .orderW1P ~~
##      .orderW4S          0.109     NA                          NA      NA
##   .orderW2P ~~
##      .orderW4S          0.155     NA                          NA      NA
##   .orderW3P ~~
##      .orderW4S          0.126     NA                          NA      NA
##   .orderW4S ~~
##      .orderW4P          0.127     NA                          NA      NA
##   .indusW1P ~~
##      .indusW2P          0.094     NA                          NA      NA
##      .indusW3P          0.115     NA                          NA      NA
##      .indusW4P          0.106     NA                          NA      NA
##   .indusW2P ~~
##      .indusW3P          0.152     NA                          NA      NA
```

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```
##     .indusW4P              0.141        NA                       NA      NA
## .indusW3P ~~
##     .indusW4P              0.166        NA                       NA      NA
## .orderW1P ~~
##     .orderW2P              0.145        NA                       NA      NA
##     .orderW3P              0.193        NA                       NA      NA
##     .orderW4P              0.142        NA                       NA      NA
## .orderW2P ~~
##     .orderW3P              0.172        NA                       NA      NA
##     .orderW4P              0.147        NA                       NA      NA
## .orderW3P ~~
##     .orderW4P              0.204        NA                       NA      NA
##    Std.lv  Std.all
##
##    -0.061   -0.061
##
##     0.275    0.765
##     0.235    0.688
##     0.239    0.689
##     0.062    0.270
##     0.086    0.340
##     0.083    0.291
##     0.060    0.247
##
##     0.285    0.803
##     0.294    0.816
##
##     0.048    0.200
##
##     0.101    0.384
##     0.102    0.344
##     0.080    0.318
##
##     0.291    0.851
##
##     0.037    0.164
##
##     0.091    0.362
##
##     0.064    0.227
##     0.046    0.190
##
##     0.066    0.286
##
##     0.106    0.419
##
##     0.074    0.260
##
##     0.063    0.258
##
##     0.246    0.743
##     0.263    0.752
##     0.247    0.652
##     0.083    0.290
```

```
##     0.122    0.474
##     0.093    0.290
##     0.102    0.342
##
##     0.259    0.826
##     0.255    0.754
##
##     0.101    0.397
##
##     0.117    0.507
##     0.098    0.339
##     0.097    0.361
##
##     0.291    0.811
##
##     0.096    0.354
##
##     0.142    0.581
##
##     0.091    0.300
##     0.106    0.376
##
##     0.109    0.375
##
##     0.155    0.587
##
##     0.126    0.382
##
##     0.127    0.415
##
##     0.094    0.558
##     0.115    0.607
##     0.106    0.651
##
##     0.152    0.728
##     0.141    0.788
##
##     0.166    0.826
##
##     0.145    0.730
##     0.193    0.781
##     0.142    0.619
##
##     0.172    0.769
##     0.147    0.708
##
##     0.204    0.786
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      interc         3.186      NA                          NA       NA
##      slope         -0.000      NA                          NA       NA
##     .indusW1S        0.000                               0.000    0.000
##     .indusW2S        0.000                               0.000    0.000
```

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```
##     .indusW3S              0.000                        0.000    0.000
##     .indusW4S              0.000                        0.000    0.000
##     .orderW1S  (b)   -0.777    NA                     NA       NA
##     .orderW2S  (b)   -0.777    NA                     NA       NA
##     .orderW3S  (b)   -0.777    NA                     NA       NA
##     .orderW4S  (b)   -0.777    NA                     NA       NA
##     .indusW1P  (c)  -12.202    NA                     NA       NA
##     .indusW2P  (c)  -12.202    NA                     NA       NA
##     .indusW3P  (c)  -12.202    NA                     NA       NA
##     .indusW4P  (c)  -12.202    NA                     NA       NA
##     .orderW1P  (d)  -11.001    NA                     NA       NA
##     .orderW2P  (d)  -11.001    NA                     NA       NA
##     .orderW3P  (d)  -11.001    NA                     NA       NA
##     .orderW4P  (d)  -11.001    NA                     NA       NA
##     .consci1               0.000                        0.000    0.000
##     .consci2               0.000                        0.000    0.000
##     .consci3               0.000                        0.000    0.000
##     .consci4               0.000                        0.000    0.000
##     Std.lv   Std.all
##     40.371    40.371
##          NA        NA
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##     -0.777    -1.249
##     -0.777    -1.395
##     -0.777    -1.327
##     -0.777    -1.229
##    -12.202   -19.548
##    -12.202   -20.000
##    -12.202   -19.790
##    -12.202   -21.019
##    -11.001   -17.103
##    -11.001   -19.066
##    -11.001   -17.409
##    -11.001   -17.906
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .indusW1S         0.346     NA                        NA       NA
##     .orderW1S         0.369     NA                        NA       NA
##     .indusW1P         0.154     NA                        NA       NA
##     .orderW1P         0.220     NA                        NA       NA
##     .indusW2S         0.373     NA                        NA       NA
##     .orderW2S         0.296     NA                        NA       NA
##     .indusW2P         0.186     NA                        NA       NA
##     .orderW2P         0.180     NA                        NA       NA
##     .indusW3S         0.338     NA                        NA       NA
##     .orderW3S         0.332     NA                        NA       NA
```

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```
##    .indusW3P        0.234        NA                      NA        NA
##    .orderW3P        0.279        NA                      NA        NA
##    .indusW4S        0.346        NA                      NA        NA
##    .orderW4S        0.388        NA                      NA        NA
##    .indusW4P        0.171        NA                      NA        NA
##    .orderW4P        0.241        NA                      NA        NA
##    .consci1         0.003        NA                      NA        NA
##    .consci2         0.001        NA                      NA        NA
##    .consci3         0.000        NA                      NA        NA
##    .consci4         0.002        NA                      NA        NA
##     interc          0.006        NA                      NA        NA
##     slope          -0.000        NA                      NA        NA
##    Std.lv  Std.all
##    0.346    0.973
##    0.369    0.954
##    0.154    0.395
##    0.220    0.531
##    0.373    0.980
##    0.296    0.954
##    0.186    0.500
##    0.180    0.540
##    0.338    0.983
##    0.332    0.968
##    0.234    0.616
##    0.279    0.699
##    0.346    0.981
##    0.388    0.969
##    0.171    0.509
##    0.241    0.639
##    0.342    0.342
##    0.191    0.191
##    0.038    0.038
##    0.231    0.231
##    1.000    1.000
##       NA       NA
```

```r
semPaths(lgmConsci, what = "col", whatLabels = "est", intercepts = T)
```
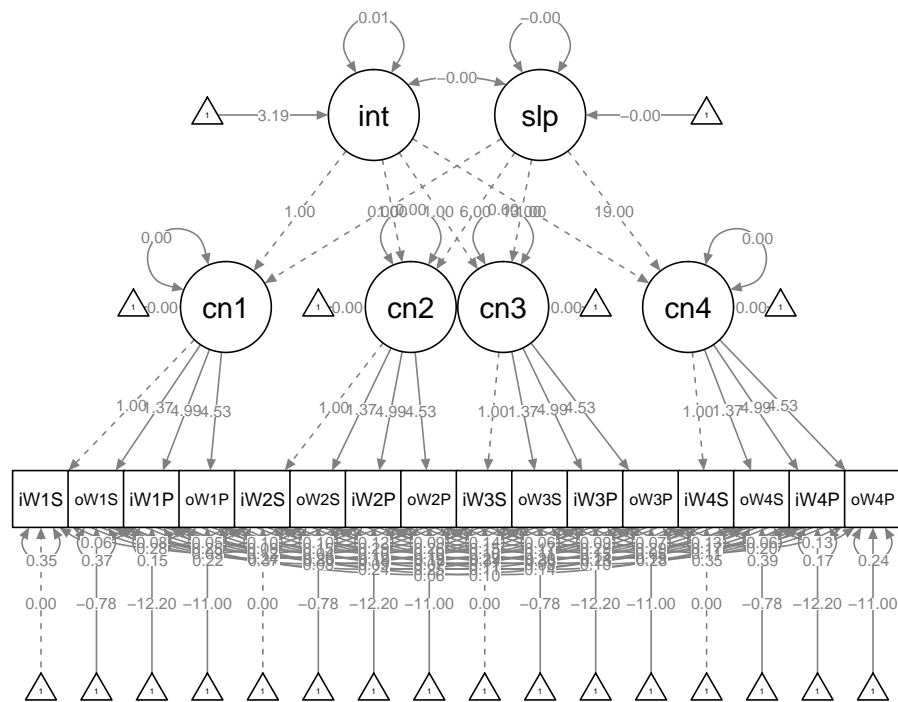
with random parcels

```
lgmConsci <- '

# factor at each time point with same loading
consci1 =~ consciW1S1        + a * consciW1S2 +
           peer * consciW1P1 + aa * consciW1P2

consci2 =~ consciW2S1        + a * consciW2S2 +
           peer * consciW2P1 + aa * consciW2P2

consci3 =~ consciW3S1        + a * consciW3S2 +
           peer * consciW3P1 + aa * consciW3P2

consci4 =~ consciW4S1        + a * consciW4S2 +
           peer * consciW4P1 + aa * consciW4P2

# second order factor for intercept and slope
interc =~ 1*consci1 + 1*consci2 + 1*consci3 + 1*consci4
slope =~ 0*consci1 + 6*consci2 + 13*consci3 + 19*consci4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
```

```
consciW1S1 ~ 0*1
consciW2S1 ~ 0*1
consciW3S1 ~ 0*1
consciW4S1 ~ 0*1

# fix equal intercepts
consciW1S2 ~ b*1
consciW2S2 ~ b*1
consciW3S2 ~ b*1
consciW4S2 ~ b*1


consciW1P1 ~ c*1
consciW2P1 ~ c*1
consciW3P1 ~ c*1
consciW4P1 ~ c*1


consciW1P2 ~ d*1
consciW2P2 ~ d*1
consciW3P2 ~ d*1
consciW4P2 ~ d*1


# error covariance - similar parcels across waves
consciW1S1 ~~ consciW2S1 + consciW3S1 + consciW4S1
consciW2S1 ~~ consciW3S1 + consciW4S1
consciW3S1 ~~ consciW4S1

consciW1S2 ~~ consciW2S2 + consciW3S2 + consciW4S2
consciW2S2 ~~ consciW3S2 + consciW4S2
consciW3S2 ~~ consciW4S2

consciW1P1 ~~ consciW2P1 + consciW3P1 + consciW4P1
consciW2P1 ~~ consciW3P1 + consciW4P1
consciW3P1 ~~ consciW4P1

consciW1P2 ~~ consciW2P2 + consciW3P2 + consciW4P2
consciW2P2 ~~ consciW3P2 + consciW4P2
consciW3P2 ~~ consciW4P2

# error covariance - same method at one wave
consciW1S1 ~~ consciW1S2
consciW1P1 ~~ consciW1P2
consciW2S1 ~~ consciW2S2
consciW2P1 ~~ consciW2P2
consciW3S1 ~~ consciW3S2
consciW3P1 ~~ consciW3P2
consciW4S1 ~~ consciW4S2
consciW4P1 ~~ consciW4P2
'
lgmConsci <- sem(lgmConsci, data = data, missing = "ML")
```

Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
lavaan WARNING: the optimizer warns that a solution has NOT been found!

Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :

```
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!
```

```r
summary(lgmConsci, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 did NOT end normally after 364 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA

## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge

##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on               Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   consci1 =~
##     cnsW1S1           1.000                                1.000    1.000
##     cnsW1S2    (a)    0.912       NA                          NA       NA
##     cnsW1P1 (peer)    0.989       NA                          NA       NA
##     cnsW1P2   (aa)    0.885       NA                          NA       NA
##   consci2 =~
##     cnsW2S1           1.000                                1.000    1.000
##     cnsW2S2    (a)    0.912       NA                          NA       NA
##     cnsW2P1 (peer)    0.989       NA                          NA       NA
##     cnsW2P2   (aa)    0.885       NA                          NA       NA
##   consci3 =~
##     cnsW3S1           1.000                                1.000    1.000
##     cnsW3S2    (a)    0.912       NA                          NA       NA
##     cnsW3P1 (peer)    0.989       NA                          NA       NA
##     cnsW3P2   (aa)    0.885       NA                          NA       NA
##   consci4 =~
##     cnsW4S1           1.000                                1.000    1.000
##     cnsW4S2    (a)    0.912       NA                          NA       NA
##     cnsW4P1 (peer)    0.989       NA                          NA       NA
##     cnsW4P2   (aa)    0.885       NA                          NA       NA
```

```
##    interc =~
##      consci1              1.000                                      1.000    1.000
##      consci2              1.000                                      1.000    1.000
##      consci3              1.000                                      1.000    1.000
##      consci4              1.000                                      1.000    1.000
##    slope =~
##      consci1              0.000                                      0.000    0.000
##      consci2              6.000                                      6.000    6.000
##      consci3             13.000                                     13.000   13.000
##      consci4             19.000                                     19.000   19.000
##    Std.lv  Std.all
##
##     1.566    0.917
##     1.428    0.926
##     1.548    0.963
##     1.385    0.973
##
##     1.380    0.966
##     1.259    0.977
##     1.365    0.936
##     1.221    0.911
##
##     1.369    0.978
##     1.248    0.956
##     1.353    0.917
##     1.211    0.912
##
##     1.386    0.986
##     1.264    0.958
##     1.371    0.936
##     1.226    0.918
##
##     0.856    0.856
##     0.971    0.971
##     0.980    0.980
##     0.967    0.967
##
##       NA      NA
##       NA      NA
##       NA      NA
##       NA      NA
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    interc ~~
##      slope              0.006      NA                         NA       NA
##   .consciW1S1 ~~
##     .consciW2S1         0.060      NA                         NA       NA
##     .consciW3S1         0.023      NA                         NA       NA
##     .consciW4S1         0.071      NA                         NA       NA
##   .consciW2S1 ~~
##     .consciW3S1         0.021      NA                         NA       NA
##     .consciW4S1         0.025      NA                         NA       NA
##   .consciW3S1 ~~
```

```
##    .consciW4S1          0.010      NA                     NA      NA
## .consciW1S2 ~~
##    .consciW2S2         -0.001      NA                     NA      NA
##    .consciW3S2          0.032      NA                     NA      NA
##    .consciW4S2         -0.014      NA                     NA      NA
## .consciW2S2 ~~
##    .consciW3S2          0.038      NA                     NA      NA
##    .consciW4S2          0.031      NA                     NA      NA
## .consciW3S2 ~~
##    .consciW4S2          0.041      NA                     NA      NA
## .consciW1P1 ~~
##    .consciW2P1          0.050      NA                     NA      NA
##    .consciW3P1          0.086      NA                     NA      NA
##    .consciW4P1          0.034      NA                     NA      NA
## .consciW2P1 ~~
##    .consciW3P1          0.243      NA                     NA      NA
##    .consciW4P1          0.187      NA                     NA      NA
## .consciW3P1 ~~
##    .consciW4P1          0.250      NA                     NA      NA
## .consciW1P2 ~~
##    .consciW2P2          0.222      NA                     NA      NA
##    .consciW3P2          0.213      NA                     NA      NA
##    .consciW4P2          0.206      NA                     NA      NA
## .consciW2P2 ~~
##    .consciW3P2          0.302      NA                     NA      NA
##    .consciW4P2          0.295      NA                     NA      NA
## .consciW3P2 ~~
##    .consciW4P2          0.289      NA                     NA      NA
## .consciW1S1 ~~
##    .consciW1S2          0.325      NA                     NA      NA
## .consciW1P1 ~~
##    .consciW1P2          0.000      NA                     NA      NA
## .consciW2S1 ~~
##    .consciW2S2          0.027      NA                     NA      NA
## .consciW2P1 ~~
##    .consciW2P2         -0.000      NA                     NA      NA
## .consciW3S1 ~~
##    .consciW3S2          0.047      NA                     NA      NA
## .consciW3P1 ~~
##    .consciW3P2          0.000      NA                     NA      NA
## .consciW4S1 ~~
##    .consciW4S2          0.033      NA                     NA      NA
## .consciW4P1 ~~
##    .consciW4P2          0.000      NA                     NA      NA
##    Std.lv  Std.all
##
##    0.231    0.231
##
##    0.060    0.239
##    0.023    0.115
##    0.071    0.446
##
##    0.021    0.198
##    0.025    0.284
```

```
##
##      0.010    0.148
##
##     -0.001   -0.005
##      0.032    0.145
##     -0.014   -0.064
##
##      0.038    0.358
##      0.031    0.299
##
##      0.041    0.282
##
##      0.050    0.224
##      0.086    0.336
##      0.034    0.150
##
##      0.243    0.807
##      0.187    0.707
##
##      0.250    0.822
##
##      0.222    1.226
##      0.213    1.200
##      0.206    1.192
##
##      0.302    1.002
##      0.295    1.002
##
##      0.289    1.003
##
##      0.325    0.820
##
##      0.000    0.003
##
##      0.027    0.263
##
##     -0.000   -0.000
##
##      0.047    0.418
##
##      0.000    0.000
##
##      0.033    0.376
##
##      0.000    0.000
##
## Intercepts:
##                 Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##      interc        3.547       NA                          NA       NA
##      slope         0.000       NA                          NA       NA
##    .consciW1S1      0.000                              0.000    0.000
##    .consciW2S1      0.000                              0.000    0.000
##    .consciW3S1      0.000                              0.000    0.000
##    .consciW4S1      0.000                              0.000    0.000
```

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```
##      .consciW1S2 (b)     0.389       NA                      NA      NA
##      .consciW2S2 (b)     0.389       NA                      NA      NA
##      .consciW3S2 (b)     0.389       NA                      NA      NA
##      .consciW4S2 (b)     0.389       NA                      NA      NA
##      .consciW1P1 (c)     0.305       NA                      NA      NA
##      .consciW2P1 (c)     0.305       NA                      NA      NA
##      .consciW3P1 (c)     0.305       NA                      NA      NA
##      .consciW4P1 (c)     0.305       NA                      NA      NA
##      .consciW1P2 (d)     0.403       NA                      NA      NA
##      .consciW2P2 (d)     0.403       NA                      NA      NA
##      .consciW3P2 (d)     0.403       NA                      NA      NA
##      .consciW4P2 (d)     0.403       NA                      NA      NA
##      .consci1            0.000                           0.000   0.000
##      .consci2            0.000                           0.000   0.000
##      .consci3            0.000                           0.000   0.000
##      .consci4            0.000                           0.000   0.000
##    Std.lv  Std.all
##    2.646    2.646
##       NA       NA
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.389    0.253
##    0.389    0.302
##    0.389    0.298
##    0.389    0.295
##    0.305    0.189
##    0.305    0.209
##    0.305    0.206
##    0.305    0.208
##    0.403    0.283
##    0.403    0.301
##    0.403    0.304
##    0.403    0.302
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      .consciW1S1     0.462       NA                      NA      NA
##      .consciW1S2     0.339       NA                      NA      NA
##      .consciW1P1     0.189       NA                      NA      NA
##      .consciW1P2     0.107       NA                      NA      NA
##      .consciW2S1     0.136       NA                      NA      NA
##      .consciW2S2     0.075       NA                      NA      NA
##      .consciW2P1     0.262       NA                      NA      NA
##      .consciW2P2     0.307       NA                      NA      NA
##      .consciW3S1     0.086       NA                      NA      NA
##      .consciW3S2     0.147       NA                      NA      NA
##      .consciW3P1     0.346       NA                      NA      NA
##      .consciW3P2     0.296       NA                      NA      NA
```

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```
##     .consciW4S1          0.055        NA                          NA       NA
##     .consciW4S2          0.142        NA                          NA       NA
##     .consciW4P1          0.267        NA                          NA       NA
##     .consciW4P2          0.281        NA                          NA       NA
##     .consci1             0.655        NA                          NA       NA
##     .consci2             0.047        NA                          NA       NA
##     .consci3            -0.018        NA                          NA       NA
##     .consci4             0.037        NA                          NA       NA
##      interc              1.797        NA                          NA       NA
##      slope              -0.000        NA                          NA       NA
##     Std.lv   Std.all
##     0.462     0.159
##     0.339     0.143
##     0.189     0.073
##     0.107     0.053
##     0.136     0.067
##     0.075     0.045
##     0.262     0.123
##     0.307     0.171
##     0.086     0.044
##     0.147     0.086
##     0.346     0.159
##     0.296     0.168
##     0.055     0.028
##     0.142     0.081
##     0.267     0.124
##     0.281     0.158
##     0.267     0.267
##     0.024     0.024
##    -0.010    -0.010
##     0.019     0.019
##     1.000     1.000
##        NA        NA
```

```r
semPaths(lgmConsci, what = "col", whatLabels = "est", intercepts = T)
```
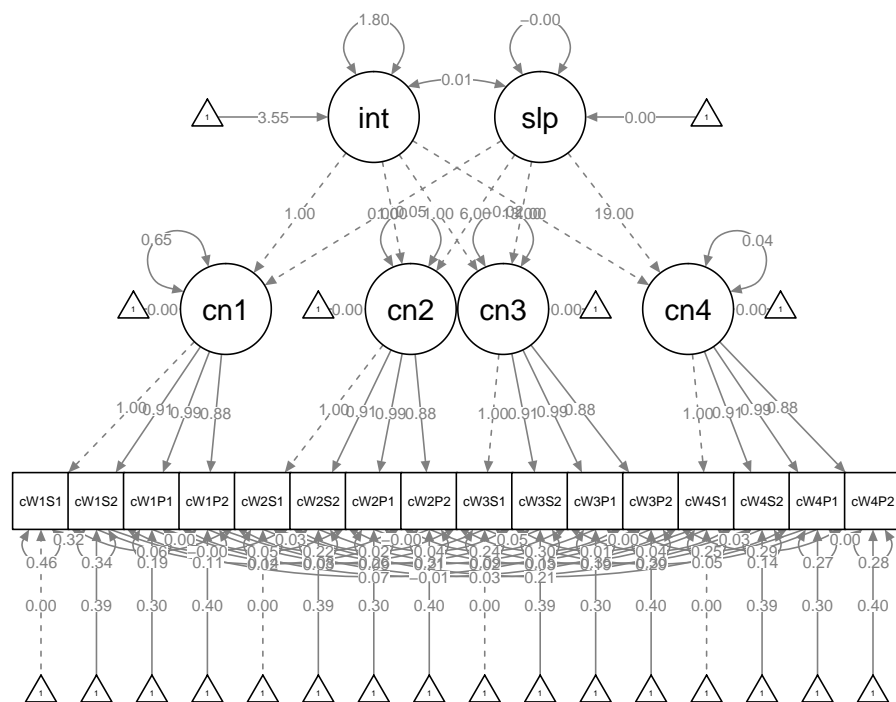
LGM Extraversion

with aspects as parcels

```
lgmExtra <- '

# factor at each time point with same loading
extra1 =~ assertW1S         + a * enthuW1S +
         peer * assertW1P + aa * enthuW1P

extra2 =~ assertW2S         + a * enthuW2S +
         peer * assertW2P + aa * enthuW2P

extra3 =~ assertW3S         + a * enthuW3S +
         peer * assertW3P + aa * enthuW3P

extra4 =~ assertW4S         + a * enthuW4S +
         peer * assertW4P + aa * enthuW4P

# second order factor for intercept and slope
interc =~ 1*extra1 + 1*extra2 + 1*extra3 + 1*extra4
slope =~ 0*extra1 + 6*extra2 + 13*extra3 + 19*extra4
interc ~~ slope
interc ~ 1
slope ~ 1
```

```
# fix zero intercepts
assertW1S ~ 0*1
assertW2S ~ 0*1
assertW3S ~ 0*1
assertW4S ~ 0*1

# fix equal intercepts
enthuW1S ~ b*1
enthuW2S ~ b*1
enthuW3S ~ b*1
enthuW4S ~ b*1

assertW1P ~ c*1
assertW2P ~ c*1
assertW3P ~ c*1
assertW4P ~ c*1

enthuW1P ~ d*1
enthuW2P ~ d*1
enthuW3P ~ d*1
enthuW4P ~ d*1

# error covariance - similar aspects across waves and informants
assertW1S ~~ assertW2S + assertW3S + assertW4S +
            assertW1P + assertW2P + assertW3P + assertW4P
assertW2S ~~ assertW3S + assertW4S +
            assertW1P + assertW2P + assertW3P + assertW4P
assertW3S ~~ assertW4S +
            assertW1P + assertW2P + assertW3P + assertW4P
assertW4S ~~ assertW1P + assertW2P + assertW3P + assertW4P

enthuW1S ~~ enthuW2S + enthuW3S + enthuW4S +
            enthuW1P + enthuW2P + enthuW3P + enthuW4P
enthuW2S ~~ enthuW3S + enthuW4S +
            enthuW1P + enthuW2P + enthuW3P + enthuW4P
enthuW3S ~~ enthuW4S +
            enthuW1P + enthuW2P + enthuW3P + enthuW4P
enthuW4S ~~ enthuW1P + enthuW2P + enthuW3P + enthuW4P

assertW1P ~~ assertW2P + assertW3P + assertW4P
assertW2P ~~ assertW3P + assertW4P
assertW3P ~~ assertW4P

enthuW1P ~~ enthuW2P + enthuW3P + enthuW4P
enthuW2P ~~ enthuW3P + enthuW4P
enthuW3P ~~ enthuW4P
'
lgmExtra <- sem(lgmExtra, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                but not all elements of the gradient are (near) zero;
##                the optimizer may not have found a local solution
##                use check.gradient = FALSE to skip this check.
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                   but not all elements of the gradient are (near) zero;
##                   the optimizer may not have found a local solution
##                   use check.gradient = FALSE to skip this check.

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                   but not all elements of the gradient are (near) zero;
##                   the optimizer may not have found a local solution
##                   use check.gradient = FALSE to skip this check.

## Warning in lav_object_post_check(object): lavaan WARNING: some estimated ov
## variances are negative

## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```r
summary(lgmExtra, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 1083 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                        105
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                               150.466
##   Degrees of freedom                                65
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2412.811
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.963
##   Tucker-Lewis Index (TLI)                       0.931
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1277.743
##   Loglikelihood unrestricted model (H1)      -1202.510
##
##   Akaike (AIC)                                2729.486
##   Bayesian (BIC)                              3038.930
##   Sample-size adjusted Bayesian (BIC)         2763.108
##
## Root Mean Square Error of Approximation:
##
```

```
##    RMSEA                                           0.071
##    90 Percent confidence interval - lower          0.056
##    90 Percent confidence interval - upper          0.086
##    P-value RMSEA <= 0.05                            0.011
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                             0.087
##
## Parameter Estimates:
##
##    Standard errors                              Standard
##    Information                                  Observed
##    Observed information based on                 Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    extra1 =~
##      assrW1S           1.000                                    1.000    1.000
##      enthW1S    (a)    0.006    0.001    4.726    0.000    0.003    0.008
##      assrW1P (peer)    1.236       NA                               NA       NA
##      enthW1P   (aa)    0.008    0.001    5.988    0.000    0.005    0.011
##    extra2 =~
##      assrW2S           1.000                                    1.000    1.000
##      enthW2S    (a)    0.006    0.001    4.747    0.000    0.003    0.008
##      assrW2P (peer)    1.236       NA                               NA       NA
##      enthW2P   (aa)    0.008    0.001    5.923    0.000    0.005    0.011
##    extra3 =~
##      assrW3S           1.000                                    1.000    1.000
##      enthW3S    (a)    0.006    0.001    4.691    0.000    0.003    0.008
##      assrW3P (peer)    1.236       NA                               NA       NA
##      enthW3P   (aa)    0.008    0.001    5.874    0.000    0.005    0.011
##    extra4 =~
##      assrW4S           1.000                                    1.000    1.000
##      enthW4S    (a)    0.006    0.001    4.756    0.000    0.003    0.008
##      assrW4P (peer)    1.236       NA                               NA       NA
##      enthW4P   (aa)    0.008    0.001    6.106    0.000    0.006    0.011
##    interc =~
##      extra1            1.000                                    1.000    1.000
##      extra2            1.000                                    1.000    1.000
##      extra3            1.000                                    1.000    1.000
##      extra4            1.000                                    1.000    1.000
##    slope =~
##      extra1            0.000                                    0.000    0.000
##      extra2            6.000                                    6.000    6.000
##      extra3           13.000                                   13.000   13.000
##      extra4           19.000                                   19.000   19.000
##    Std.lv  Std.all
##
##    4.024    5.963
##    0.022    0.035
##    4.973    8.142
##    0.033    0.053
##
```

```
##     3.980    5.807
##     0.022    0.036
##     4.919    8.469
##     0.032    0.054
##
##     3.563    5.261
##     0.020    0.032
##     4.404    7.782
##     0.029    0.056
##
##     3.392    4.994
##     0.019    0.029
##     4.192    8.008
##     0.028    0.053
##
##     1.003    1.003
##     1.014    1.014
##     1.132    1.132
##     1.190    1.190
##
##     0.000    0.000
##     0.167    0.167
##     0.405    0.405
##     0.621    0.621
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope            -0.237    0.093   -2.553    0.011   -0.419   -0.055
## .assertW1S ~~
##    .assertW2S       -14.475    0.688  -21.032    0.000  -15.824  -13.126
##    .assertW3S       -12.820    0.200  -64.142    0.000  -13.212  -12.428
##    .assertW4S       -11.429    0.581  -19.657    0.000  -12.568  -10.289
##    .assertW1P       -19.830    1.619  -12.249    0.000  -23.003  -16.657
##    .assertW2P       -18.205    1.017  -17.906    0.000  -20.197  -16.212
##    .assertW3P       -16.179    0.392  -41.296    0.000  -16.947  -15.411
##    .assertW4P       -14.437    0.674  -21.419    0.000  -15.758  -13.116
## .assertW2S ~~
##    .assertW3S       -12.333    0.187  -66.012    0.000  -12.699  -11.967
##    .assertW4S       -11.367    0.659  -17.245    0.000  -12.659  -10.075
## .assertW1P ~~
##    .assertW2S       -18.171    1.015  -17.895    0.000  -20.161  -16.181
## .assertW2S ~~
##    .assertW2P       -19.408    0.987  -19.665    0.000  -21.342  -17.474
##    .assertW3P       -15.600    0.208  -74.957    0.000  -16.007  -15.192
##    .assertW4P       -14.419    0.731  -19.716    0.000  -15.853  -12.986
## .assertW3S ~~
##    .assertW4S       -11.325    1.017  -11.139    0.000  -13.318   -9.333
## .assertW1P ~~
##    .assertW3S       -16.153    0.389  -41.565    0.000  -16.915  -15.391
## .assertW2P ~~
##    .assertW3S       -15.596    0.206  -75.784    0.000  -15.999  -15.192
## .assertW3S ~~
##    .assertW3P       -15.564    0.905  -17.193    0.000  -17.338  -13.790
```

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```
##     .assertW4P      -14.403    1.170  -12.310    0.000  -16.696  -12.110
## .assertW1P ~~
##     .assertW4S      -14.391    0.674  -21.359    0.000  -15.712  -13.071
## .assertW2P ~~
##     .assertW4S      -14.374    0.731  -19.651    0.000  -15.808  -12.940
## .assertW3P ~~
##     .assertW4S      -14.377    1.172  -12.272    0.000  -16.674  -12.081
## .assertW4S ~~
##     .assertW4P      -14.103    1.757   -8.028    0.000  -17.546  -10.660
## .enthuW1S ~~
##     .enthuW2S         0.309    0.032    9.684    0.000    0.246    0.371
##     .enthuW3S         0.285    0.031    9.111    0.000    0.223    0.346
##     .enthuW4S         0.299    0.033    8.968    0.000    0.234    0.364
##     .enthuW1P         0.170    0.031    5.466    0.000    0.109    0.231
##     .enthuW2P         0.157    0.030    5.163    0.000    0.097    0.216
##     .enthuW3P         0.106    0.026    4.050    0.000    0.055    0.157
##     .enthuW4P         0.079    0.030    2.625    0.009    0.020    0.137
## .enthuW2S ~~
##     .enthuW3S         0.322    0.033    9.698    0.000    0.257    0.387
##     .enthuW4S         0.325    0.035    9.376    0.000    0.257    0.393
## .enthuW1P ~~
##     .enthuW2S         0.159    0.031    5.118    0.000    0.098    0.219
## .enthuW2S ~~
##     .enthuW2P         0.152    0.031    4.947    0.000    0.092    0.212
##     .enthuW3P         0.116    0.026    4.457    0.000    0.065    0.167
##     .enthuW4P         0.067    0.031    2.195    0.028    0.007    0.127
## .enthuW3S ~~
##     .enthuW4S         0.340    0.036    9.461    0.000    0.269    0.410
## .enthuW1P ~~
##     .enthuW3S         0.163    0.031    5.255    0.000    0.102    0.224
## .enthuW2P ~~
##     .enthuW3S         0.168    0.030    5.598    0.000    0.109    0.227
## .enthuW3S ~~
##     .enthuW3P         0.113    0.026    4.329    0.000    0.062    0.164
##     .enthuW4P         0.095    0.029    3.277    0.001    0.038    0.151
## .enthuW1P ~~
##     .enthuW4S         0.174    0.034    5.196    0.000    0.108    0.240
## .enthuW2P ~~
##     .enthuW4S         0.174    0.032    5.428    0.000    0.111    0.236
## .enthuW3P ~~
##     .enthuW4S         0.122    0.028    4.351    0.000    0.067    0.176
## .enthuW4S ~~
##     .enthuW4P         0.089    0.032    2.839    0.005    0.028    0.151
## .assertW1P ~~
##     .assertW2P      -22.420    1.426  -15.719    0.000  -25.216  -19.625
##     .assertW3P      -19.888    0.601  -33.089    0.000  -21.066  -18.710
##     .assertW4P      -17.756    0.770  -23.050    0.000  -19.266  -16.246
## .assertW2P ~~
##     .assertW3P      -19.178    0.202  -94.973    0.000  -19.574  -18.782
##     .assertW4P      -17.715    0.785  -22.570    0.000  -19.253  -16.177
## .assertW3P ~~
##     .assertW4P      -17.677    1.334  -13.255    0.000  -20.291  -15.063
## .enthuW1P ~~
##     .enthuW2P         0.300    0.037    8.196    0.000    0.228    0.372
```

```
##    .enthuW3P              0.248   0.032   7.853   0.000   0.186   0.310
##    .enthuW4P              0.220   0.033   6.596   0.000   0.155   0.286
## .enthuW2P ~~
##    .enthuW3P              0.246   0.030   8.071   0.000   0.186   0.306
##    .enthuW4P              0.230   0.033   6.874   0.000   0.164   0.295
## .enthuW3P ~~
##    .enthuW4P              0.226   0.030   7.440   0.000   0.167   0.286
##    Std.lv  Std.all
##
##    -0.530   -0.530
##
##   -14.475   -0.931
##   -12.820   -0.924
##   -11.429   -0.867
##   -19.830   -1.013
##   -18.205   -0.939
##   -16.179   -0.934
##   -14.437   -0.875
##
##   -12.333   -0.899
##   -11.367   -0.872
##
##   -18.171   -0.939
##
##   -19.408   -1.013
##   -15.600   -0.911
##   -14.419   -0.884
##
##   -11.325   -0.974
##
##   -16.153   -0.935
##
##   -15.596   -0.913
##
##   -15.564   -1.019
##   -14.403   -0.990
##
##   -14.391   -0.877
##
##   -14.374   -0.885
##
##   -14.377   -0.991
##
##   -14.103   -1.020
##
##     0.309    0.780
##     0.285    0.717
##     0.299    0.729
##     0.170    0.435
##     0.157    0.411
##     0.106    0.321
##     0.079    0.235
##
##     0.322    0.825
```

```
##     0.325     0.807
##
##     0.159     0.413
##
##     0.152     0.405
##     0.116     0.357
##     0.067     0.205
##
##     0.340     0.842
##
##     0.163     0.425
##
##     0.168     0.448
##
##     0.113     0.347
##     0.095     0.288
##
##     0.174     0.438
##
##     0.174     0.449
##
##     0.122     0.362
##
##     0.089     0.264
##
##   -22.420    -0.930
##   -19.888    -0.923
##   -17.756    -0.865
##
##   -19.178    -0.899
##   -17.715    -0.872
##
##   -17.677    -0.973
##
##     0.300     0.813
##     0.248     0.776
##     0.220     0.682
##
##     0.246     0.788
##     0.230     0.729
##
##     0.226     0.828
##
## Intercepts:
##                 Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     interc         3.452    0.042   82.559    0.000    3.371    3.534
##     slope         -0.001    0.001   -0.766    0.444   -0.003    0.001
##   .assertW1S        0.000                              0.000    0.000
##   .assertW2S        0.000                              0.000    0.000
##   .assertW3S        0.000                              0.000    0.000
##   .assertW4S        0.000                              0.000    0.000
##   .enthuW1S  (b)    3.690    0.036  102.239    0.000    3.620    3.761
##   .enthuW2S  (b)    3.690    0.036  102.239    0.000    3.620    3.761
##   .enthuW3S  (b)    3.690    0.036  102.239    0.000    3.620    3.761
```

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```
##     .enthuW4S   (b)      3.690   0.036  102.239    0.000     3.620    3.761
##     .assertW1P  (c)     -0.641   0.048  -13.229    0.000    -0.736   -0.546
##     .assertW2P  (c)     -0.641   0.048  -13.229    0.000    -0.736   -0.546
##     .assertW3P  (c)     -0.641   0.048  -13.229    0.000    -0.736   -0.546
##     .assertW4P  (c)     -0.641   0.048  -13.229    0.000    -0.736   -0.546
##     .enthuW1P   (d)      3.801   0.038   99.350    0.000     3.726    3.876
##     .enthuW2P   (d)      3.801   0.038   99.350    0.000     3.726    3.876
##     .enthuW3P   (d)      3.801   0.038   99.350    0.000     3.726    3.876
##     .enthuW4P   (d)      3.801   0.038   99.350    0.000     3.726    3.876
##     .extra1               0.000                              0.000    0.000
##     .extra2               0.000                              0.000    0.000
##     .extra3               0.000                              0.000    0.000
##     .extra4               0.000                              0.000    0.000
##     Std.lv  Std.all
##      0.856    0.856
##     -0.008   -0.008
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##      3.690    5.811
##      3.690    5.908
##      3.690    5.897
##      3.690    5.713
##     -0.641   -1.049
##     -0.641   -1.103
##     -0.641   -1.133
##     -0.641   -1.224
##      3.801    6.171
##      3.801    6.327
##      3.801    7.295
##      3.801    7.223
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##
## Variances:
##                      Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .assertW1S        -15.739    1.191  -13.214    0.000  -18.073  -13.404
##     .enthuW1S           0.403    0.035   11.466    0.000    0.334    0.472
##     .assertW1P        -24.362    2.163  -11.262    0.000  -28.602  -20.122
##     .enthuW1P           0.378    0.042    9.100    0.000    0.297    0.460
##     .assertW2S        -15.373    0.715  -21.488    0.000  -16.775  -13.971
##     .enthuW2S           0.390    0.036   10.775    0.000    0.319    0.461
##     .assertW2P        -23.861    1.329  -17.960    0.000  -26.465  -21.257
##     .enthuW2P           0.360    0.039    9.155    0.000    0.283    0.437
##     .assertW3S        -12.238    0.774  -15.819    0.000  -13.755  -10.722
##     .enthuW3S           0.391    0.037   10.622    0.000    0.319    0.463
##     .assertW3P        -19.073    1.050  -18.166    0.000  -21.131  -17.015
##     .enthuW3P           0.271    0.030    9.101    0.000    0.212    0.329
##     .assertW4S        -11.045    1.492   -7.403    0.000  -13.969   -8.121
##     .enthuW4S           0.417    0.042    9.886    0.000    0.334    0.500
##     .assertW4P        -17.300    2.062   -8.390    0.000  -21.342  -13.259
```

```
##      .enthuW4P           0.276    0.036    7.581    0.000    0.205    0.348
##      .extra1            -0.090    1.014   -0.088    0.930   -2.078    1.899
##      .extra2             1.962    0.712    2.757    0.006    0.567    3.356
##      .extra3             0.500    0.557    0.897    0.370   -0.592    1.591
##      .extra4            -0.207    0.843   -0.245    0.806   -1.860    1.446
##       interc            16.284    1.234   13.194    0.000   13.865   18.703
##       slope              0.012    0.005    2.269    0.023    0.002    0.023
##     Std.lv  Std.all
##    -15.739  -34.563
##      0.403    0.999
##    -24.362  -65.288
##      0.378    0.997
##    -15.373  -32.720
##      0.390    0.999
##    -23.861  -70.719
##      0.360    0.997
##    -12.238  -26.677
##      0.391    0.999
##    -19.073  -59.562
##      0.271    0.997
##    -11.045  -23.935
##      0.417    0.999
##    -17.300  -63.127
##      0.276    0.997
##     -0.006   -0.006
##      0.124    0.124
##      0.039    0.039
##     -0.018   -0.018
##      1.000    1.000
##      1.000    1.000
```

```r
semPaths(lgmExtra, what = "col", whatLabels = "est", intercepts = T)
```
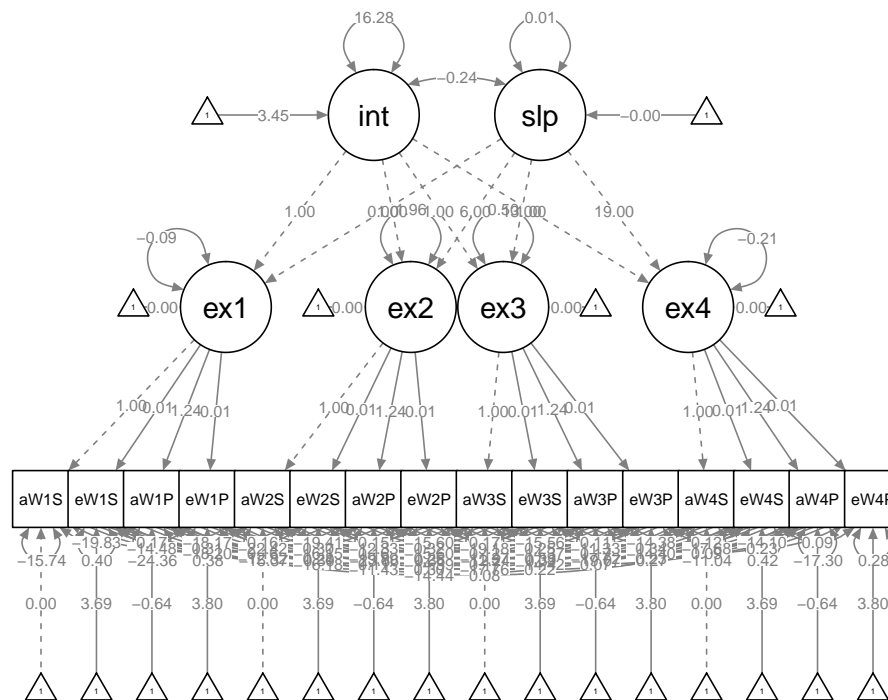
with random parcels

```
lgmExtra <- '

# factor at each time point with same loading
extra1 =~ extraW1S1        + a * extraW1S2 +
          peer * extraW1P1 + aa * extraW1P2

extra2 =~ extraW2S1        + a * extraW2S2 +
          peer * extraW2P1 + aa * extraW2P2

extra3 =~ extraW3S1        + a * extraW3S2 +
          peer * extraW3P1 + aa * extraW3P2

extra4 =~ extraW4S1        + a * extraW4S2 +
          peer * extraW4P1 + aa * extraW4P2

# second order factor for intercept and slope
interc =~ 1*extra1 + 1*extra2 + 1*extra3 + 1*extra4
slope =~ 0*extra1 + 6*extra2 + 13*extra3 + 19*extra4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
```

```
extraW1S1 ~ 0*1
extraW2S1 ~ 0*1
extraW3S1 ~ 0*1
extraW4S1 ~ 0*1

# fix equal intercepts
extraW1S2 ~ b*1
extraW2S2 ~ b*1
extraW3S2 ~ b*1
extraW4S2 ~ b*1

extraW1P1 ~ c*1
extraW2P1 ~ c*1
extraW3P1 ~ c*1
extraW4P1 ~ c*1

extraW1P2 ~ d*1
extraW2P2 ~ d*1
extraW3P2 ~ d*1
extraW4P2 ~ d*1

# error covariance - similar parcels across waves
extraW1S1 ~~ extraW2S1 + extraW3S1 + extraW4S1
extraW2S1 ~~ extraW3S1 + extraW4S1
extraW3S1 ~~ extraW4S1

extraW1S2 ~~ extraW2S2 + extraW3S2 + extraW4S2
extraW2S2 ~~ extraW3S2 + extraW4S2
extraW3S2 ~~ extraW4S2

extraW1P1 ~~ extraW2P1 + extraW3P1 + extraW4P1
extraW2P1 ~~ extraW3P1 + extraW4P1
extraW3P1 ~~ extraW4P1

extraW1P2 ~~ extraW2P2 + extraW3P2 + extraW4P2
extraW2P2 ~~ extraW3P2 + extraW4P2
extraW3P2 ~~ extraW4P2

# error covariance - same method at one wave
extraW1S1 ~~ extraW1S2
extraW1P1 ~~ extraW1P2
extraW2S1 ~~ extraW2S2
extraW2P1 ~~ extraW2P2
extraW3S1 ~~ extraW3S2
extraW3P1 ~~ extraW3P2
extraW4S1 ~~ extraW4S2
extraW4P1 ~~ extraW4P2
'
lgmExtra <- sem(lgmExtra, data = data, missing = "ML")

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
```

```
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!
```
```r
summary(lgmExtra, fit.measures = T, standardized = T, ci = T)
```
```
## lavaan 0.6-7 did NOT end normally after 390 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA

## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge

##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   extra1 =~
##     extW1S1            1.000                              1.000    1.000
##     extW1S2    (a)     0.899       NA                        NA       NA
##     extW1P1 (peer)     0.944       NA                        NA       NA
##     extW1P2   (aa)     0.903       NA                        NA       NA
##   extra2 =~
##     extW2S1            1.000                              1.000    1.000
##     extW2S2    (a)     0.899       NA                        NA       NA
##     extW2P1 (peer)     0.944       NA                        NA       NA
##     extW2P2   (aa)     0.903       NA                        NA       NA
##   extra3 =~
##     extW3S1            1.000                              1.000    1.000
##     extW3S2    (a)     0.899       NA                        NA       NA
##     extW3P1 (peer)     0.944       NA                        NA       NA
##     extW3P2   (aa)     0.903       NA                        NA       NA
##   extra4 =~
##     extW4S1            1.000                              1.000    1.000
##     extW4S2    (a)     0.899       NA                        NA       NA
##     extW4P1 (peer)     0.944       NA                        NA       NA
##     extW4P2   (aa)     0.903       NA                        NA       NA
```

```
##   interc =~
##     extra1              1.000                                    1.000    1.000
##     extra2              1.000                                    1.000    1.000
##     extra3              1.000                                    1.000    1.000
##     extra4              1.000                                    1.000    1.000
##   slope =~
##     extra1              0.000                                    0.000    0.000
##     extra2              6.000                                    6.000    6.000
##     extra3             13.000                                   13.000   13.000
##     extra4             19.000                                   19.000   19.000
##    Std.lv  Std.all
##
##    1.522    0.942
##    1.369    0.949
##    1.437    0.953
##    1.375    0.982
##
##    1.356    0.982
##    1.219    0.966
##    1.280    0.922
##    1.224    0.938
##
##    1.332    0.970
##    1.198    0.945
##    1.258    0.953
##    1.203    0.942
##
##    1.363    0.962
##    1.225    0.966
##    1.287    0.961
##    1.230    0.943
##
##    0.845    0.845
##    0.949    0.949
##    0.966    0.966
##    0.944    0.944
##
##       NA       NA
##       NA       NA
##       NA       NA
##       NA       NA
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope             0.010       NA                          NA       NA
##  .extraW1S1 ~~
##    .extraW2S1         0.018       NA                          NA       NA
##    .extraW3S1         0.025       NA                          NA       NA
##    .extraW4S1         0.033       NA                          NA       NA
##  .extraW2S1 ~~
##    .extraW3S1         0.029       NA                          NA       NA
##    .extraW4S1         0.018       NA                          NA       NA
##  .extraW3S1 ~~
```

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```
##     .extraW4S1          0.040         NA                    NA      NA
## .extraW1S2 ~~
##     .extraW2S2          0.030         NA                    NA      NA
##     .extraW3S2          0.012         NA                    NA      NA
##     .extraW4S2          0.018         NA                    NA      NA
## .extraW2S2 ~~
##     .extraW3S2         -0.017         NA                    NA      NA
##     .extraW4S2          0.020         NA                    NA      NA
## .extraW3S2 ~~
##     .extraW4S2          0.011         NA                    NA      NA
## .extraW1P1 ~~
##     .extraW2P1          0.074         NA                    NA      NA
##     .extraW3P1          0.067         NA                    NA      NA
##     .extraW4P1          0.075         NA                    NA      NA
## .extraW2P1 ~~
##     .extraW3P1          0.158         NA                    NA      NA
##     .extraW4P1          0.123         NA                    NA      NA
## .extraW3P1 ~~
##     .extraW4P1          0.080         NA                    NA      NA
## .extraW1P2 ~~
##     .extraW2P2          0.161         NA                    NA      NA
##     .extraW3P2          0.145         NA                    NA      NA
##     .extraW4P2          0.144         NA                    NA      NA
## .extraW2P2 ~~
##     .extraW3P2          0.194         NA                    NA      NA
##     .extraW4P2          0.197         NA                    NA      NA
## .extraW3P2 ~~
##     .extraW4P2          0.187         NA                    NA      NA
## .extraW1S1 ~~
##     .extraW1S2          0.187         NA                    NA      NA
## .extraW1P1 ~~
##     .extraW1P2          0.001         NA                    NA      NA
## .extraW2S1 ~~
##     .extraW2S2          0.026         NA                    NA      NA
## .extraW2P1 ~~
##     .extraW2P2          0.000         NA                    NA      NA
## .extraW3S1 ~~
##     .extraW3S2          0.092         NA                    NA      NA
## .extraW3P1 ~~
##     .extraW3P2         -0.000         NA                    NA      NA
## .extraW4S1 ~~
##     .extraW4S2          0.058         NA                    NA      NA
## .extraW4P1 ~~
##     .extraW4P2         -0.000         NA                    NA      NA
##    Std.lv  Std.all
##
##    0.304    0.304
##
##    0.018    0.132
##    0.025    0.140
##    0.033    0.156
##
##    0.029    0.343
##    0.018    0.180
```

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```
##
##     0.040    0.308
##
##     0.030    0.198
##     0.012    0.061
##     0.018    0.122
##
##    -0.017   -0.124
##     0.020    0.187
##
##     0.011    0.080
##
##     0.074    0.305
##     0.067    0.370
##     0.075    0.441
##
##     0.158    0.739
##     0.123    0.616
##
##     0.080    0.540
##
##     0.161    1.365
##     0.145    1.294
##     0.144    1.270
##
##     0.194    1.005
##     0.197    1.007
##
##     0.187    1.005
##
##     0.187    0.757
##
##     0.001    0.005
##
##     0.026    0.314
##
##     0.000    0.000
##
##     0.092    0.662
##
##    -0.000   -0.000
##
##     0.058    0.454
##
##    -0.000   -0.000
##
## Intercepts:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##       interc           3.599       NA                         NA       NA
##       slope           -0.000       NA                         NA       NA
##     .extraW1S1         0.000                              0.000    0.000
##     .extraW2S1         0.000                              0.000    0.000
##     .extraW3S1         0.000                              0.000    0.000
##     .extraW4S1         0.000                              0.000    0.000
```

```
##    .extraW1S2  (b)    0.356      NA                          NA      NA
##    .extraW2S2  (b)    0.356      NA                          NA      NA
##    .extraW3S2  (b)    0.356      NA                          NA      NA
##    .extraW4S2  (b)    0.356      NA                          NA      NA
##    .extraW1P1  (c)    0.264      NA                          NA      NA
##    .extraW2P1  (c)    0.264      NA                          NA      NA
##    .extraW3P1  (c)    0.264      NA                          NA      NA
##    .extraW4P1  (c)    0.264      NA                          NA      NA
##    .extraW1P2  (d)    0.569      NA                          NA      NA
##    .extraW2P2  (d)    0.569      NA                          NA      NA
##    .extraW3P2  (d)    0.569      NA                          NA      NA
##    .extraW4P2  (d)    0.569      NA                          NA      NA
##    .extra1            0.000                          0.000   0.000
##    .extra2            0.000                          0.000   0.000
##    .extra3            0.000                          0.000   0.000
##    .extra4            0.000                          0.000   0.000
##    Std.lv   Std.all
##    2.796    2.796
##      NA       NA
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.356    0.247
##    0.356    0.282
##    0.356    0.281
##    0.356    0.281
##    0.264    0.175
##    0.264    0.190
##    0.264    0.200
##    0.264    0.197
##    0.569    0.406
##    0.569    0.436
##    0.569    0.445
##    0.569    0.436
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .extraW1S1         0.294      NA                          NA      NA
##    .extraW1S2         0.209      NA                          NA      NA
##    .extraW1P1         0.207      NA                          NA      NA
##    .extraW1P2         0.068      NA                          NA      NA
##    .extraW2S1         0.066      NA                          NA      NA
##    .extraW2S2         0.106      NA                          NA      NA
##    .extraW2P1         0.288      NA                          NA      NA
##    .extraW2P2         0.203      NA                          NA      NA
##    .extraW3S1         0.110      NA                          NA      NA
##    .extraW3S2         0.173      NA                          NA      NA
##    .extraW3P1         0.158      NA                          NA      NA
##    .extraW3P2         0.183      NA                          NA      NA
```

```
##    .extraW4S1        0.151       NA                      NA        NA
##    .extraW4S2        0.108       NA                      NA        NA
##    .extraW4P1        0.138       NA                      NA        NA
##    .extraW4P2        0.189       NA                      NA        NA
##    .extra1           0.662       NA                      NA        NA
##    .extra2           0.084       NA                      NA        NA
##    .extra3          -0.031       NA                      NA        NA
##    .extra4           0.061       NA                      NA        NA
##     interc           1.656       NA                      NA        NA
##     slope           -0.001       NA                      NA        NA
##    Std.lv  Std.all
##     0.294    0.113
##     0.209    0.100
##     0.207    0.091
##     0.068    0.035
##     0.066    0.035
##     0.106    0.067
##     0.288    0.149
##     0.203    0.119
##     0.110    0.059
##     0.173    0.108
##     0.158    0.091
##     0.183    0.112
##     0.151    0.075
##     0.108    0.067
##     0.138    0.077
##     0.189    0.111
##     0.285    0.285
##     0.046    0.046
##    -0.018   -0.018
##     0.033    0.033
##     1.000    1.000
##       NA       NA
```

```r
semPaths(lgmExtra, what = "col", whatLabels = "est", intercepts = T)
```
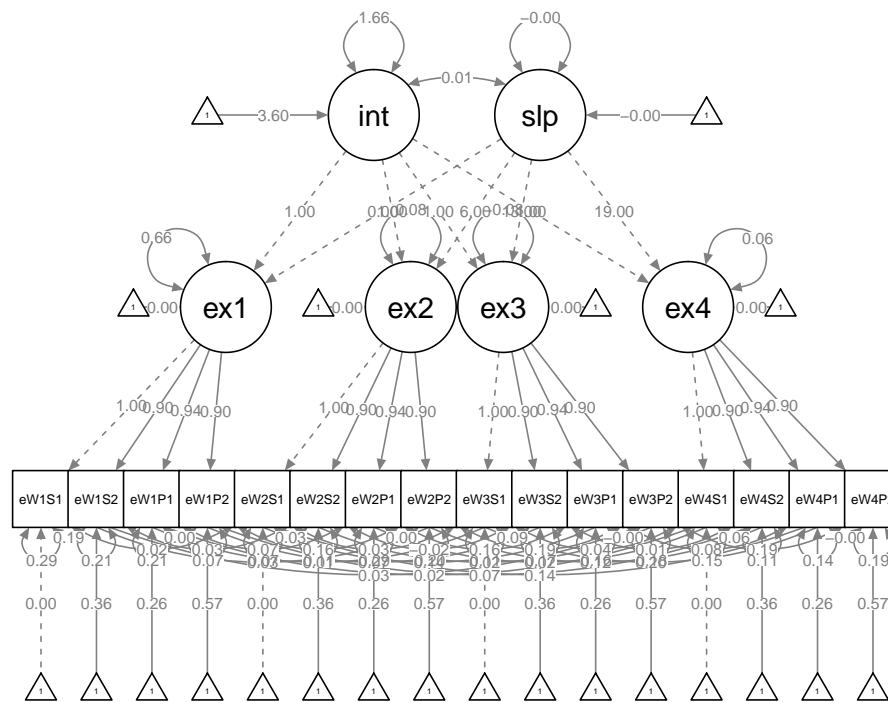
LGM Neuroticism

with aspects as parcels

```
lgmNeuro <- '

# factor at each time point with same loading
neuro1 =~ volatW1S        + a * withdW1S +
         peer * volatW1P + aa * withdW1P

neuro2 =~ volatW2S        + a * withdW2S +
         peer * volatW2P + aa * withdW2P

neuro3 =~ volatW3S        + a * withdW3S +
         peer * volatW3P + aa * withdW3P

neuro4 =~ volatW4S        + a * withdW4S +
         peer * volatW4P + aa * withdW4P

# second order factor for intercept and slope
interc =~ 1*neuro1 + 1*neuro2 + 1*neuro3 + 1*neuro4
slope =~ 0*neuro1 + 6*neuro2 + 13*neuro3 + 19*neuro4
interc ~~ slope
interc ~ 1
slope ~ 1
```

```r
# fix zero intercepts
volatW1S ~ 0*1
volatW2S ~ 0*1
volatW3S ~ 0*1
volatW4S ~ 0*1

# fix equal intercepts
withdW1S ~ b*1
withdW2S ~ b*1
withdW3S ~ b*1
withdW4S ~ b*1

volatW1P ~ c*1
volatW2P ~ c*1
volatW3P ~ c*1
volatW4P ~ c*1

withdW1P ~ d*1
withdW2P ~ d*1
withdW3P ~ d*1
withdW4P ~ d*1

# error covariance - similar aspects across waves and informants
volatW1S ~~ volatW2S + volatW3S + volatW4S +
            volatW1P + volatW2P + volatW3P + volatW4P
volatW2S ~~ volatW3S + volatW4S +
            volatW1P + volatW2P + volatW3P + volatW4P
volatW3S ~~ volatW4S +
            volatW1P + volatW2P + volatW3P + volatW4P
volatW4S ~~ volatW1P + volatW2P + volatW3P + volatW4P

withdW1S ~~ withdW2S + withdW3S + withdW4S +
            withdW1P + withdW2P + withdW3P + withdW4P
withdW2S ~~ withdW3S + withdW4S +
            withdW1P + withdW2P + withdW3P + withdW4P
withdW3S ~~ withdW4S +
            withdW1P + withdW2P + withdW3P + withdW4P
withdW4S ~~ withdW1P + withdW2P + withdW3P + withdW4P

volatW1P ~~ volatW2P + volatW3P + volatW4P
volatW2P ~~ volatW3P + volatW4P
volatW3P ~~ volatW4P

withdW1P ~~ withdW2P + withdW3P + withdW4P
withdW2P ~~ withdW3P + withdW4P
withdW3P ~~ withdW4P
'
lgmNeuro <- sem(lgmNeuro, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                  but not all elements of the gradient are (near) zero;
##                  the optimizer may not have found a local solution
##                  use check.gradient = FALSE to skip this check.
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: the covariance matrix of the residuals of
##                variables (theta) is not positive definite;
##                use lavInspect(fit, "theta") to investigate.
```

```r
summary(lgmNeuro, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 243 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                        105
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                               218.197
##   Degrees of freedom                                65
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2496.820
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.936
##   Tucker-Lewis Index (TLI)                       0.881
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1658.077
##   Loglikelihood unrestricted model (H1)      -1548.979
##
##   Akaike (AIC)                                3490.155
##   Bayesian (BIC)                              3799.599
##   Sample-size adjusted Bayesian (BIC)         3523.777
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.095
##   90 Percent confidence interval - lower         0.082
##   90 Percent confidence interval - upper         0.110
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.249
##
## Parameter Estimates:
##
```

```
##    Standard errors                              Standard
##    Information                                   Observed
##    Observed information based on                  Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   neuro1 =~
##     voltW1S              1.000                                  1.000    1.000
##     wthdW1S      (a)     1.226    0.972    1.261    0.207   -0.680    3.132
##     voltW1P (peer)     -0.767    0.182   -4.222    0.000   -1.123   -0.411
##     wthdW1P     (aa)    -0.825    0.673   -1.226    0.220   -2.144    0.494
##   neuro2 =~
##     voltW2S              1.000                                  1.000    1.000
##     wthdW2S      (a)     1.226    0.972    1.261    0.207   -0.680    3.132
##     voltW2P (peer)     -0.767    0.182   -4.222    0.000   -1.123   -0.411
##     wthdW2P     (aa)    -0.825    0.673   -1.226    0.220   -2.144    0.494
##   neuro3 =~
##     voltW3S              1.000                                  1.000    1.000
##     wthdW3S      (a)     1.226    0.972    1.261    0.207   -0.680    3.132
##     voltW3P (peer)     -0.767    0.182   -4.222    0.000   -1.123   -0.411
##     wthdW3P     (aa)    -0.825    0.673   -1.226    0.220   -2.144    0.494
##   neuro4 =~
##     voltW4S              1.000                                  1.000    1.000
##     wthdW4S      (a)     1.226    0.972    1.261    0.207   -0.680    3.132
##     voltW4P (peer)     -0.767    0.182   -4.222    0.000   -1.123   -0.411
##     wthdW4P     (aa)    -0.825    0.673   -1.226    0.220   -2.144    0.494
##   interc =~
##     neuro1               1.000                                  1.000    1.000
##     neuro2               1.000                                  1.000    1.000
##     neuro3               1.000                                  1.000    1.000
##     neuro4               1.000                                  1.000    1.000
##   slope =~
##     neuro1               0.000                                  0.000    0.000
##     neuro2               6.000                                  6.000    6.000
##     neuro3              13.000                                 13.000   13.000
##     neuro4              19.000                                 19.000   19.000
##    Std.lv  Std.all
##
##    0.364    0.475
##    0.446    0.636
##   -0.279   -0.370
##   -0.300   -0.457
##
##    0.341    0.429
##    0.418    0.607
##   -0.262   -0.343
##   -0.282   -0.422
##
##    0.345    0.461
##    0.423    0.640
##   -0.265   -0.364
##   -0.285   -0.451
##
##    0.383    0.485
```

```
##     0.469    0.694
##    -0.293   -0.381
##    -0.316   -0.494
##
##     0.867    0.867
##     0.924    0.924
##     0.914    0.914
##     0.824    0.824
##
##     0.000    0.000
##     0.173    0.173
##     0.371    0.371
##     0.489    0.489
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   interc ~~
##     slope            -0.000    0.001   -0.495    0.621    -0.002     0.001
##  .volatW1S ~~
##    .volatW2S          0.404    0.090    4.510    0.000     0.228     0.580
##    .volatW3S          0.349    0.085    4.101    0.000     0.182     0.515
##    .volatW4S          0.349    0.085    4.092    0.000     0.182     0.516
##    .volatW1P          0.279    0.090    3.090    0.002     0.102     0.455
##    .volatW2P          0.277    0.071    3.876    0.000     0.137     0.416
##    .volatW3P          0.253    0.069    3.647    0.000     0.117     0.388
##    .volatW4P          0.281    0.070    4.026    0.000     0.144     0.418
##  .volatW2S ~~
##    .volatW3S          0.424    0.092    4.626    0.000     0.244     0.604
##    .volatW4S          0.400    0.094    4.266    0.000     0.216     0.584
##  .volatW1P ~~
##    .volatW2S          0.275    0.074    3.703    0.000     0.129     0.420
##  .volatW2S ~~
##    .volatW2P          0.337    0.085    3.992    0.000     0.172     0.503
##    .volatW3P          0.286    0.074    3.863    0.000     0.141     0.431
##    .volatW4P          0.290    0.077    3.768    0.000     0.139     0.442
##  .volatW3S ~~
##    .volatW4S          0.371    0.099    3.740    0.000     0.177     0.566
##  .volatW1P ~~
##    .volatW3S          0.256    0.070    3.664    0.000     0.119     0.394
##  .volatW2P ~~
##    .volatW3S          0.290    0.074    3.922    0.000     0.145     0.435
##  .volatW3S ~~
##    .volatW3P          0.251    0.083    3.036    0.002     0.089     0.414
##    .volatW4P          0.247    0.081    3.046    0.002     0.088     0.405
##  .volatW1P ~~
##    .volatW4S          0.248    0.071    3.482    0.000     0.108     0.388
##  .volatW2P ~~
##    .volatW4S          0.255    0.076    3.358    0.001     0.106     0.403
##  .volatW3P ~~
##    .volatW4S          0.225    0.079    2.863    0.004     0.071     0.379
##  .volatW4S ~~
##    .volatW4P          0.223    0.102    2.187    0.029     0.023     0.422
##  .withdW1S ~~
##    .withdW2S          0.225    0.125    1.802    0.072    -0.020     0.469
```

```
##    .withdW3S          0.208   0.120   1.729   0.084   -0.028   0.444
##    .withdW4S          0.212   0.118   1.792   0.073   -0.020   0.444
##    .withdW1P          0.263   0.112   2.360   0.018    0.045   0.482
##    .withdW2P          0.264   0.085   3.109   0.002    0.098   0.431
##    .withdW3P          0.236   0.082   2.874   0.004    0.075   0.397
##    .withdW4P          0.232   0.082   2.831   0.005    0.071   0.393
## .withdW2S ~~
##    .withdW3S          0.212   0.127   1.673   0.094   -0.036   0.460
##    .withdW4S          0.198   0.128   1.542   0.123   -0.054   0.450
## .withdW1P ~~
##    .withdW2S          0.220   0.086   2.567   0.010    0.052   0.389
## .withdW2S ~~
##    .withdW2P          0.275   0.100   2.739   0.006    0.078   0.472
##    .withdW3P          0.219   0.086   2.541   0.011    0.050   0.388
##    .withdW4P          0.236   0.088   2.683   0.007    0.064   0.408
## .withdW3S ~~
##    .withdW4S          0.192   0.139   1.376   0.169   -0.081   0.465
## .withdW1P ~~
##    .withdW3S          0.199   0.082   2.421   0.015    0.038   0.361
## .withdW2P ~~
##    .withdW3S          0.237   0.086   2.756   0.006    0.069   0.406
## .withdW3S ~~
##    .withdW3P          0.247   0.101   2.457   0.014    0.050   0.445
##    .withdW4P          0.226   0.095   2.387   0.017    0.040   0.412
## .withdW1P ~~
##    .withdW4S          0.194   0.081   2.406   0.016    0.036   0.353
## .withdW2P ~~
##    .withdW4S          0.242   0.087   2.788   0.005    0.072   0.413
## .withdW3P ~~
##    .withdW4S          0.230   0.094   2.444   0.015    0.046   0.415
## .withdW4S ~~
##    .withdW4P          0.274   0.123   2.219   0.026    0.032   0.515
## .volatW1P ~~
##    .volatW2P          0.386   0.071   5.425   0.000    0.247   0.526
##    .volatW3P          0.344   0.069   5.017   0.000    0.210   0.479
##    .volatW4P          0.327   0.071   4.620   0.000    0.188   0.466
## .volatW2P ~~
##    .volatW3P          0.400   0.074   5.436   0.000    0.256   0.545
##    .volatW4P          0.423   0.079   5.323   0.000    0.267   0.579
## .volatW3P ~~
##    .volatW4P          0.376   0.080   4.672   0.000    0.218   0.533
## .withdW1P ~~
##    .withdW2P          0.280   0.068   4.113   0.000    0.146   0.413
##    .withdW3P          0.274   0.067   4.110   0.000    0.143   0.404
##    .withdW4P          0.225   0.065   3.456   0.001    0.097   0.353
## .withdW2P ~~
##    .withdW3P          0.280   0.070   4.031   0.000    0.144   0.417
##    .withdW4P          0.276   0.071   3.906   0.000    0.138   0.415
## .withdW3P ~~
##    .withdW4P          0.264   0.076   3.479   0.001    0.115   0.412
##    Std.lv  Std.all
##
##    -0.135   -0.135
##
```

85

```
##     0.404    0.836
##     0.349    0.781
##     0.349    0.750
##     0.279    0.590
##     0.277    0.574
##     0.253    0.555
##     0.281    0.586
##
##     0.424    0.891
##     0.400    0.808
##
##     0.275    0.546
##
##     0.337    0.656
##     0.286    0.590
##     0.290    0.569
##
##     0.371    0.810
##
##     0.256    0.551
##
##     0.290    0.611
##
##     0.251    0.560
##     0.247    0.522
##
##     0.248    0.512
##
##     0.255    0.515
##
##     0.225    0.482
##
##     0.223    0.453
##
##     0.225    0.760
##     0.208    0.758
##     0.212    0.807
##     0.263    0.834
##     0.264    0.809
##     0.236    0.775
##     0.232    0.773
##
##     0.212    0.762
##     0.198    0.744
##
##     0.220    0.690
##
##     0.275    0.832
##     0.219    0.712
##     0.236    0.776
##
##     0.192    0.775
##
##     0.199    0.671
```

```
## 
##      0.237    0.773
## 
##      0.247    0.864
##      0.226    0.801
## 
##      0.194    0.683
## 
##      0.242    0.824
## 
##      0.230    0.840
## 
##      0.274    1.011
## 
##      0.386    0.769
##      0.344    0.726
##      0.327    0.656
## 
##      0.400    0.827
##      0.423    0.830
## 
##      0.376    0.781
## 
##      0.280    0.793
##      0.274    0.832
##      0.225    0.693
## 
##      0.280    0.824
##      0.276    0.823
## 
##      0.264    0.842
## 
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      interc          2.784    0.047   59.529    0.000    2.693    2.876
##      slope          -0.002    0.002   -1.147    0.251   -0.006    0.002
##     .volatW1S         0.000                              0.000    0.000
##     .volatW2S         0.000                              0.000    0.000
##     .volatW3S         0.000                              0.000    0.000
##     .volatW4S         0.000                              0.000    0.000
##     .withdW1S  (b)   -0.397    2.690   -0.147    0.883   -5.670    4.876
##     .withdW2S  (b)   -0.397    2.690   -0.147    0.883   -5.670    4.876
##     .withdW3S  (b)   -0.397    2.690   -0.147    0.883   -5.670    4.876
##     .withdW4S  (b)   -0.397    2.690   -0.147    0.883   -5.670    4.876
##     .volatW1P  (c)    4.725    0.506    9.342    0.000    3.734    5.716
##     .volatW2P  (c)    4.725    0.506    9.342    0.000    3.734    5.716
##     .volatW3P  (c)    4.725    0.506    9.342    0.000    3.734    5.716
##     .volatW4P  (c)    4.725    0.506    9.342    0.000    3.734    5.716
##     .withdW1P  (d)    4.864    1.864    2.610    0.009    1.211    8.517
##     .withdW2P  (d)    4.864    1.864    2.610    0.009    1.211    8.517
##     .withdW3P  (d)    4.864    1.864    2.610    0.009    1.211    8.517
##     .withdW4P  (d)    4.864    1.864    2.610    0.009    1.211    8.517
##     .neuro1           0.000                              0.000    0.000
##     .neuro2           0.000                              0.000    0.000
```

```
##    .neuro3              0.000                                          0.000    0.000
##    .neuro4              0.000                                          0.000    0.000
##    Std.lv  Std.all
##    8.831    8.831
##   -0.228   -0.228
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##   -0.397   -0.566
##   -0.397   -0.576
##   -0.397   -0.600
##   -0.397   -0.587
##    4.725    6.262
##    4.725    6.198
##    4.725    6.506
##    4.725    6.140
##    4.864    7.405
##    4.864    7.298
##    4.864    7.709
##    4.864    7.609
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##    .volatW1S          0.453    0.115    3.951    0.000     0.228    0.678
##    .withdW1S          0.292    0.166    1.759    0.079    -0.033    0.617
##    .volatW1P          0.492    0.088    5.583    0.000     0.319    0.664
##    .withdW1P          0.342    0.087    3.920    0.000     0.171    0.512
##    .volatW2S          0.515    0.107    4.799    0.000     0.305    0.725
##    .withdW2S          0.299    0.149    2.012    0.044     0.008    0.591
##    .volatW2P          0.513    0.085    6.006    0.000     0.345    0.680
##    .withdW2P          0.365    0.080    4.534    0.000     0.207    0.523
##    .volatW3S          0.440    0.106    4.159    0.000     0.233    0.648
##    .withdW3S          0.258    0.150    1.719    0.086    -0.036    0.553
##    .volatW3P          0.457    0.083    5.491    0.000     0.294    0.621
##    .withdW3P          0.317    0.082    3.890    0.000     0.157    0.477
##    .volatW4S          0.477    0.128    3.722    0.000     0.226    0.728
##    .withdW4S          0.237    0.185    1.279    0.201    -0.126    0.600
##    .volatW4P          0.506    0.105    4.836    0.000     0.301    0.711
##    .withdW4P          0.309    0.097    3.181    0.001     0.119    0.499
##    .neuro1            0.033    0.028    1.169    0.242    -0.022    0.088
##    .neuro2            0.018    0.016    1.167    0.243    -0.013    0.049
##    .neuro3            0.014    0.013    1.115    0.265    -0.011    0.039
##    .neuro4            0.028    0.025    1.135    0.257    -0.020    0.076
##     interc            0.099    0.081    1.229    0.219    -0.059    0.258
##     slope             0.000    0.000    1.041    0.298    -0.000    0.000
##    Std.lv  Std.all
##    0.453    0.774
##    0.292    0.595
##    0.492    0.863
```
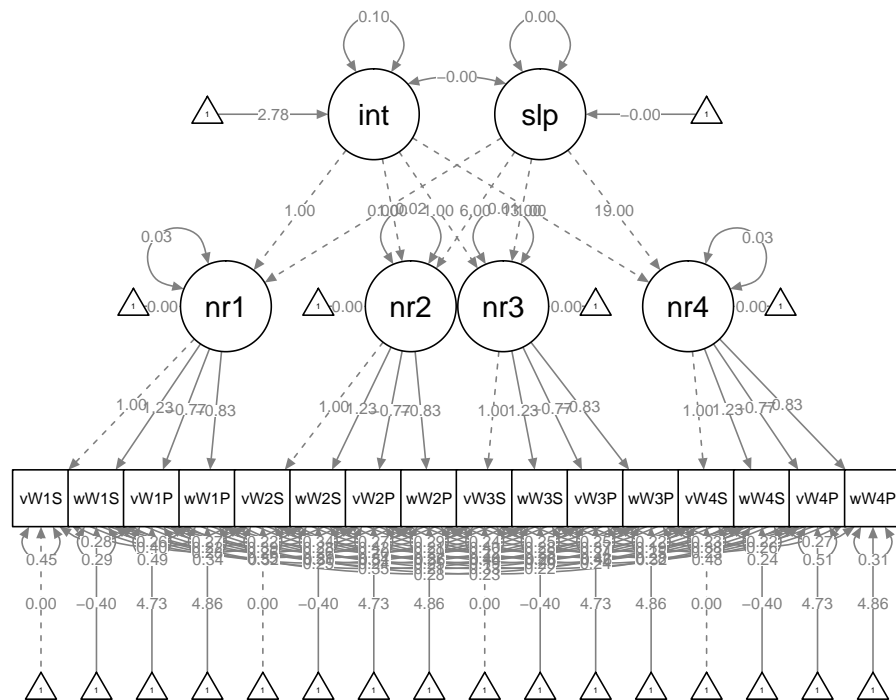
```
##     0.342     0.791
##     0.515     0.816
##     0.299     0.631
##     0.513     0.882
##     0.365     0.822
##     0.440     0.787
##     0.258     0.591
##     0.457     0.867
##     0.317     0.796
##     0.477     0.765
##     0.237     0.519
##     0.506     0.855
##     0.309     0.756
##     0.248     0.248
##     0.159     0.159
##     0.118     0.118
##     0.190     0.190
##     1.000     1.000
##     1.000     1.000
```

```
semPaths(lgmNeuro, what = "col", whatLabels = "est", intercepts = T)
```


with random parcels

```
lgmNeuro <- '
```

```
# factor at each time point with same loading
neuro1 =~ neuroW1S1        + a * neuroW1S2 +
          peer * neuroW1P1 + aa * neuroW1P2

neuro2 =~ neuroW2S1        + a * neuroW2S2 +
          peer * neuroW2P1 + aa * neuroW2P2

neuro3 =~ neuroW3S1        + a * neuroW3S2 +
          peer * neuroW3P1 + aa * neuroW3P2

neuro4 =~ neuroW4S1        + a * neuroW4S2 +
          peer * neuroW4P1 + aa * neuroW4P2

# second order factor for intercept and slope
interc =~ 1*neuro1 + 1*neuro2 + 1*neuro3 + 1*neuro4
slope =~ 0*neuro1 + 6*neuro2 + 13*neuro3 + 19*neuro4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
neuroW1S1 ~ 0*1
neuroW2S1 ~ 0*1
neuroW3S1 ~ 0*1
neuroW4S1 ~ 0*1

# fix equal intercepts
neuroW1S2 ~ b*1
neuroW2S2 ~ b*1
neuroW3S2 ~ b*1
neuroW4S2 ~ b*1

neuroW1P1 ~ c*1
neuroW2P1 ~ c*1
neuroW3P1 ~ c*1
neuroW4P1 ~ c*1

neuroW1P2 ~ d*1
neuroW2P2 ~ d*1
neuroW3P2 ~ d*1
neuroW4P2 ~ d*1

# error covariance - similar parcels across waves
neuroW1S1 ~~ neuroW2S1 + neuroW3S1 + neuroW4S1
neuroW2S1 ~~ neuroW3S1 + neuroW4S1
neuroW3S1 ~~ neuroW4S1

neuroW1S2 ~~ neuroW2S2 + neuroW3S2 + neuroW4S2
neuroW2S2 ~~ neuroW3S2 + neuroW4S2
neuroW3S2 ~~ neuroW4S2

neuroW1P1 ~~ neuroW2P1 + neuroW3P1 + neuroW4P1
neuroW2P1 ~~ neuroW3P1 + neuroW4P1
```

```
neuroW3P1 ~~ neuroW4P1

neuroW1P2 ~~ neuroW2P2 + neuroW3P2 + neuroW4P2
neuroW2P2 ~~ neuroW3P2 + neuroW4P2
neuroW3P2 ~~ neuroW4P2

# error covariance - same method at one wave
neuroW1S1 ~~ neuroW1S2
neuroW1P1 ~~ neuroW1P2
neuroW2S1 ~~ neuroW2S2
neuroW2P1 ~~ neuroW2P2
neuroW3S1 ~~ neuroW3S2
neuroW3P1 ~~ neuroW3P2
neuroW4S1 ~~ neuroW4S2
neuroW4P1 ~~ neuroW4P2
'
lgmNeuro <- sem(lgmNeuro, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!
```

```
summary(lgmNeuro, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 did NOT end normally after 318 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA

## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge

##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
##
```

```
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   neuro1 =~
##     nerW1S1            1.000                            1.000    1.000
##     nerW1S2     (a)    0.900      NA                       NA       NA
##     nerW1P1 (peer)     0.807      NA                       NA       NA
##     nerW1P2    (aa)    0.736      NA                       NA       NA
##   neuro2 =~
##     nerW2S1            1.000                            1.000    1.000
##     nerW2S2     (a)    0.900      NA                       NA       NA
##     nerW2P1 (peer)     0.807      NA                       NA       NA
##     nerW2P2    (aa)    0.736      NA                       NA       NA
##   neuro3 =~
##     nerW3S1            1.000                            1.000    1.000
##     nerW3S2     (a)    0.900      NA                       NA       NA
##     nerW3P1 (peer)     0.807      NA                       NA       NA
##     nerW3P2    (aa)    0.736      NA                       NA       NA
##   neuro4 =~
##     nerW4S1            1.000                            1.000    1.000
##     nerW4S2     (a)    0.900      NA                       NA       NA
##     nerW4P1 (peer)     0.807      NA                       NA       NA
##     nerW4P2    (aa)    0.736      NA                       NA       NA
##   interc =~
##     neuro1             1.000                            1.000    1.000
##     neuro2             1.000                            1.000    1.000
##     neuro3             1.000                            1.000    1.000
##     neuro4             1.000                            1.000    1.000
##   slope =~
##     neuro1             0.000                            0.000    0.000
##     neuro2             6.000                            6.000    6.000
##     neuro3            13.000                           13.000   13.000
##     neuro4            19.000                           19.000   19.000
##    Std.lv  Std.all
##
##    0.774    0.844
##    0.696    0.800
##    0.624    0.813
##    0.570    0.851
##
##    0.763    0.886
##    0.686    0.902
##    0.616    0.750
##    0.562    0.809
##
##    0.761    0.879
##    0.685    0.874
##    0.614    0.690
##    0.560    0.812
##
##    0.767    0.859
##    0.690    0.812
##    0.619    0.763
##    0.565    0.831
##
```

```
##    0.976    0.976
##    0.990    0.990
##    0.992    0.992
##    0.985    0.985
##
##       NA       NA
##       NA       NA
##       NA       NA
##       NA       NA
##
## Covariances:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope           0.001       NA                        NA       NA
##   .neuroW1S1 ~~
##     .neuroW2S1     -0.003       NA                        NA       NA
##     .neuroW3S1      0.078       NA                        NA       NA
##     .neuroW4S1      0.044       NA                        NA       NA
##   .neuroW2S1 ~~
##     .neuroW3S1      0.050       NA                        NA       NA
##     .neuroW4S1     -0.024       NA                        NA       NA
##   .neuroW3S1 ~~
##     .neuroW4S1      0.042       NA                        NA       NA
##   .neuroW1S2 ~~
##     .neuroW2S2      0.055       NA                        NA       NA
##     .neuroW3S2      0.022       NA                        NA       NA
##     .neuroW4S2      0.045       NA                        NA       NA
##   .neuroW2S2 ~~
##     .neuroW3S2      0.010       NA                        NA       NA
##     .neuroW4S2      0.048       NA                        NA       NA
##   .neuroW3S2 ~~
##     .neuroW4S2     -0.001       NA                        NA       NA
##   .neuroW1P1 ~~
##     .neuroW2P1      0.117       NA                        NA       NA
##     .neuroW3P1      0.069       NA                        NA       NA
##     .neuroW4P1      0.046       NA                        NA       NA
##   .neuroW2P1 ~~
##     .neuroW3P1      0.134       NA                        NA       NA
##     .neuroW4P1      0.169       NA                        NA       NA
##   .neuroW3P1 ~~
##     .neuroW4P1      0.290       NA                        NA       NA
##   .neuroW1P2 ~~
##     .neuroW2P2      0.149       NA                        NA       NA
##     .neuroW3P2      0.144       NA                        NA       NA
##     .neuroW4P2      0.137       NA                        NA       NA
##   .neuroW2P2 ~~
##     .neuroW3P2      0.165       NA                        NA       NA
##     .neuroW4P2      0.155       NA                        NA       NA
##   .neuroW3P2 ~~
##     .neuroW4P2      0.153       NA                        NA       NA
##   .neuroW1S1 ~~
##     .neuroW1S2      0.166       NA                        NA       NA
##   .neuroW1P1 ~~
##     .neuroW1P2      0.000       NA                        NA       NA
```

```
##   .neuroW2S1 ~~
##      .neuroW2S2          0.058      NA                         NA        NA
##   .neuroW2P1 ~~
##      .neuroW2P2          0.000      NA                         NA        NA
##   .neuroW3S1 ~~
##      .neuroW3S2          0.071      NA                         NA        NA
##   .neuroW3P1 ~~
##      .neuroW3P2         -0.000      NA                         NA        NA
##   .neuroW4S1 ~~
##      .neuroW4S2          0.116      NA                         NA        NA
##   .neuroW4P1 ~~
##      .neuroW4P2         -0.000      NA                         NA        NA
##    Std.lv  Std.all
##
##     0.136    0.136
##
##    -0.003   -0.016
##     0.078    0.383
##     0.044    0.194
##
##     0.050    0.301
##    -0.024   -0.132
##
##     0.042    0.223
##
##     0.055    0.319
##     0.022    0.111
##     0.045    0.175
##
##     0.010    0.082
##     0.048    0.295
##
##    -0.001   -0.006
##
##     0.117    0.482
##     0.069    0.240
##     0.046    0.197
##
##     0.134    0.384
##     0.169    0.596
##
##     0.290    0.861
##
##     0.149    1.035
##     0.144    1.021
##     0.137    1.031
##
##     0.165    1.002
##     0.155    1.004
##
##     0.153    1.006
##
##     0.166    0.644
##
```

```
##    0.000    0.003
##
##    0.058    0.446
##
##    0.000    0.000
##
##    0.071    0.450
##
##   -0.000   -0.000
##
##    0.116    0.512
##
##   -0.000   -0.000
##
## Intercepts:
##                    Estimate Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      interc          2.997      NA                         NA       NA
##      slope           0.000      NA                         NA       NA
##   .neuroW1S1         0.000                              0.000    0.000
##   .neuroW2S1         0.000                              0.000    0.000
##   .neuroW3S1         0.000                              0.000    0.000
##   .neuroW4S1         0.000                              0.000    0.000
##   .neuroW1S2  (b)    0.271      NA                         NA       NA
##   .neuroW2S2  (b)    0.271      NA                         NA       NA
##   .neuroW3S2  (b)    0.271      NA                         NA       NA
##   .neuroW4S2  (b)    0.271      NA                         NA       NA
##   .neuroW1P1  (c)    0.143      NA                         NA       NA
##   .neuroW2P1  (c)    0.143      NA                         NA       NA
##   .neuroW3P1  (c)    0.143      NA                         NA       NA
##   .neuroW4P1  (c)    0.143      NA                         NA       NA
##   .neuroW1P2  (d)    0.467      NA                         NA       NA
##   .neuroW2P2  (d)    0.467      NA                         NA       NA
##   .neuroW3P2  (d)    0.467      NA                         NA       NA
##   .neuroW4P2  (d)    0.467      NA                         NA       NA
##   .neuro1            0.000                              0.000    0.000
##   .neuro2            0.000                              0.000    0.000
##   .neuro3            0.000                              0.000    0.000
##   .neuro4            0.000                              0.000    0.000
##    Std.lv   Std.all
##    3.970     3.970
##       NA        NA
##    0.000     0.000
##    0.000     0.000
##    0.000     0.000
##    0.000     0.000
##    0.271     0.311
##    0.271     0.356
##    0.271     0.346
##    0.271     0.319
##    0.143     0.187
##    0.143     0.175
##    0.143     0.161
##    0.143     0.177
##    0.467     0.697
```

```
##     0.467    0.672
##     0.467    0.676
##     0.467    0.687
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .neuroW1S1        0.242     NA                            NA       NA
##    .neuroW1S2        0.273     NA                            NA       NA
##    .neuroW1P1        0.200     NA                            NA       NA
##    .neuroW1P2        0.124     NA                            NA       NA
##    .neuroW2S1        0.160     NA                            NA       NA
##    .neuroW2S2        0.107     NA                            NA       NA
##    .neuroW2P1        0.295     NA                            NA       NA
##    .neuroW2P2        0.167     NA                            NA       NA
##    .neuroW3S1        0.171     NA                            NA       NA
##    .neuroW3S2        0.146     NA                            NA       NA
##    .neuroW3P1        0.414     NA                            NA       NA
##    .neuroW3P2        0.162     NA                            NA       NA
##    .neuroW4S1        0.209     NA                            NA       NA
##    .neuroW4S2        0.246     NA                            NA       NA
##    .neuroW4P1        0.274     NA                            NA       NA
##    .neuroW4P2        0.143     NA                            NA       NA
##    .neuro1           0.028     NA                            NA       NA
##    .neuro2           0.005     NA                            NA       NA
##    .neuro3          -0.001     NA                            NA       NA
##    .neuro4           0.008     NA                            NA       NA
##     interc           0.570     NA                            NA       NA
##     slope           -0.000     NA                            NA       NA
##    Std.lv  Std.all
##     0.242    0.288
##     0.273    0.360
##     0.200    0.339
##     0.124    0.276
##     0.160    0.215
##     0.107    0.186
##     0.295    0.437
##     0.167    0.346
##     0.171    0.228
##     0.146    0.237
##     0.414    0.523
##     0.162    0.340
##     0.209    0.262
##     0.246    0.341
##     0.274    0.417
##     0.143    0.310
##     0.047    0.047
##     0.009    0.009
##    -0.002   -0.002
##     0.013    0.013
##     1.000    1.000
```

```
##          NA          NA
```

```
semPaths(lgmNeuro, what = "col", whatLabels = "est", intercepts = T)
```
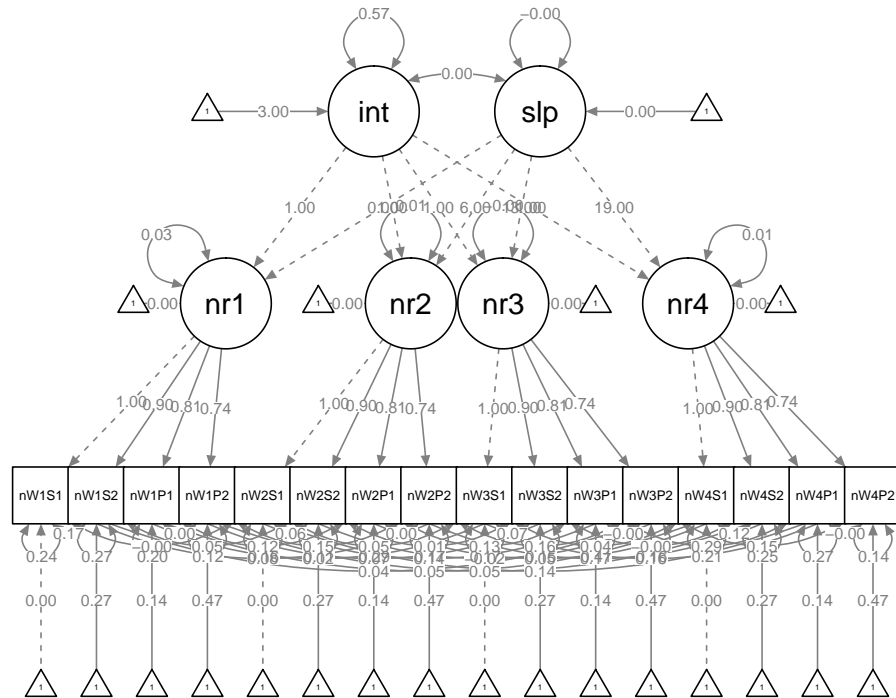

LGM Openness domain

with aspects as parcels

```
lgmOpend <- '

# factor at each time point with same loading
opend1 =~ intelW1S       + a * openaW1S +
         peer * intelW1P + aa * openaW1P

opend2 =~ intelW2S       + a * openaW2S +
         peer * intelW2P + aa * openaW2P

opend3 =~ intelW3S       + a * openaW3S +
         peer * intelW3P + aa * openaW3P

opend4 =~ intelW4S       + a * openaW4S +
         peer * intelW4P + aa * openaW4P

# second order factor for intercept and slope
interc =~ 1*opend1 + 1*opend2 + 1*opend3 + 1*opend4
slope =~ 0*opend1 + 6*opend2 + 13*opend3 + 19*opend4
interc ~~ slope
```

```
interc ~ 1
slope ~ 1

# fix zero intercepts
intelW1S ~ 0*1
intelW2S ~ 0*1
intelW3S ~ 0*1
intelW4S ~ 0*1

# fix equal intercepts
openaW1S ~ b*1
openaW2S ~ b*1
openaW3S ~ b*1
openaW4S ~ b*1

intelW1P ~ c*1
intelW2P ~ c*1
intelW3P ~ c*1
intelW4P ~ c*1

openaW1P ~ d*1
openaW2P ~ d*1
openaW3P ~ d*1
openaW4P ~ d*1

# error covariance - similar aspects across waves and informants
intelW1S ~~ intelW2S + intelW3S + intelW4S +
           intelW1P + intelW2P + intelW3P + intelW4P
intelW2S ~~ intelW3S + intelW4S +
           intelW1P + intelW2P + intelW3P + intelW4P
intelW3S ~~ intelW4S +
           intelW1P + intelW2P + intelW3P + intelW4P
intelW4S ~~ intelW1P + intelW2P + intelW3P + intelW4P

openaW1S ~~ openaW2S + openaW3S + openaW4S +
           openaW1P + openaW2P + openaW3P + openaW4P
openaW2S ~~ openaW3S + openaW4S +
           openaW1P + openaW2P + openaW3P + openaW4P
openaW3S ~~ openaW4S +
           openaW1P + openaW2P + openaW3P + openaW4P
openaW4S ~~ openaW1P + openaW2P + openaW3P + openaW4P

intelW1P ~~ intelW2P + intelW3P + intelW4P
intelW2P ~~ intelW3P + intelW4P
intelW3P ~~ intelW4P

openaW1P ~~ openaW2P + openaW3P + openaW4P
openaW2P ~~ openaW3P + openaW4P
openaW3P ~~ openaW4P
'
lgmOpend <- sem(lgmOpend, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                    but not all elements of the gradient are (near) zero;
```

```
##                    the optimizer may not have found a local solution
##                    use check.gradient = FALSE to skip this check.

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                    but not all elements of the gradient are (near) zero;
##                    the optimizer may not have found a local solution
##                    use check.gradient = FALSE to skip this check.

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                    but not all elements of the gradient are (near) zero;
##                    the optimizer may not have found a local solution
##                    use check.gradient = FALSE to skip this check.

## Warning in lav_object_post_check(object): lavaan WARNING: some estimated ov
## variances are negative
```
`summary`(lgmOpend, `fit.measures` = T, `standardized` = T, `ci` = T)

```
## lavaan 0.6-7 ended normally after 1125 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                        105
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                               137.418
##   Degrees of freedom                                65
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2293.599
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.967
##   Tucker-Lewis Index (TLI)                       0.938
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1055.056
##   Loglikelihood unrestricted model (H1)       -986.347
##
##   Akaike (AIC)                                2284.111
##   Bayesian (BIC)                              2593.555
##   Sample-size adjusted Bayesian (BIC)         2317.734
##
## Root Mean Square Error of Approximation:
##
```

```
##    RMSEA                                        0.066
##    90 Percent confidence interval - lower       0.050
##    90 Percent confidence interval - upper       0.081
##    P-value RMSEA <= 0.05                         0.047
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                         0.089
##
## Parameter Estimates:
##
##    Standard errors                           Standard
##    Information                               Observed
##    Observed information based on              Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value   P(>|z|) ci.lower ci.upper
##   opend1 =~
##     intlW1S             1.000                                  1.000    1.000
##     openW1S    (a)      0.001    0.000     4.375    0.000    0.000    0.001
##     intlW1P  (peer)     1.979    0.000  6819.914    0.000    1.978    1.979
##     openW1P   (aa)      0.001    0.000     5.896    0.000    0.001    0.001
##   opend2 =~
##     intlW2S             1.000                                  1.000    1.000
##     openW2S    (a)      0.001    0.000     4.631    0.000    0.000    0.001
##     intlW2P  (peer)     1.979    0.000  6089.929    0.000    1.978    1.979
##     openW2P   (aa)      0.001    0.000     6.981    0.000    0.001    0.001
##   opend3 =~
##     intlW3S             1.000                                  1.000    1.000
##     openW3S    (a)      0.001    0.000     4.084    0.000    0.000    0.001
##     intlW3P  (peer)     1.979    0.000  7322.770    0.000    1.978    1.979
##     openW3P   (aa)      0.001    0.000     5.966    0.000    0.001    0.001
##   opend4 =~
##     intlW4S             1.000                                  1.000    1.000
##     openW4S    (a)      0.001    0.000     4.133    0.000    0.000    0.001
##     intlW4P  (peer)     1.979    0.000  7802.412    0.000    1.978    1.979
##     openW4P   (aa)      0.001    0.000     6.245    0.000    0.001    0.001
##   interc =~
##     opend1             1.000                                  1.000    1.000
##     opend2             1.000                                  1.000    1.000
##     opend3             1.000                                  1.000    1.000
##     opend4             1.000                                  1.000    1.000
##   slope =~
##     opend1             0.000                                  0.000    0.000
##     opend2             6.000                                  6.000    6.000
##     opend3            13.000                                 13.000   13.000
##     opend4            19.000                                 19.000   19.000
##    Std.lv  Std.all
##
##    7.927   14.493
##    0.005    0.009
##   15.686   28.182
##    0.008    0.016
##
```

100

```
##     7.860    14.587
##     0.005     0.008
##    15.552    30.974
##     0.008     0.015
##
##     7.582    13.888
##     0.005     0.008
##    15.001    26.138
##     0.008     0.014
##
##     8.245    15.806
##     0.006     0.009
##    16.314    28.893
##     0.008     0.015
##
##     0.862     0.862
##     0.869     0.869
##     0.901     0.901
##     0.829     0.829
##
##     0.000     0.000
##     0.042     0.042
##     0.095     0.095
##     0.128     0.128
##
## Covariances:
##                   Estimate  Std.Err  z-value   P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope            0.339       NA                         NA       NA
##  .intelW1S ~~
##    .intelW2S        -48.505    0.018 -2731.739   0.000  -48.540  -48.470
##    .intelW3S        -50.880    0.018 -2905.535   0.000  -50.914  -50.846
##    .intelW4S        -52.931    0.017 -3066.015   0.000  -52.965  -52.897
##    .intelW1P       -124.251    0.014 -8658.906   0.000 -124.279 -124.222
##    .intelW2P        -96.368    0.017 -5596.464   0.000  -96.401  -96.334
##    .intelW3P       -101.045    0.016 -6138.351   0.000 -101.077 -101.013
##    .intelW4P       -105.114    0.020 -5224.111   0.000 -105.153 -105.074
##  .intelW2S ~~
##    .intelW3S        -53.145    0.018 -2882.772   0.000  -53.181  -53.109
##    .intelW4S        -55.307    0.018 -3041.130   0.000  -55.343  -55.271
##  .intelW1P ~~
##    .intelW2S        -96.344    0.012 -8262.344   0.000  -96.367  -96.321
##  .intelW2S ~~
##    .intelW2P       -122.180    0.022 -5502.392   0.000 -122.224 -122.137
##    .intelW3P       -105.552    0.019 -5455.181   0.000 -105.589 -105.514
##    .intelW4P       -109.836    0.018 -6069.986   0.000 -109.872 -109.801
##  .intelW3S ~~
##    .intelW4S        -58.076    0.018 -3216.416   0.000  -58.111  -58.041
##  .intelW1P ~~
##    .intelW3S       -101.014    0.016 -6513.441   0.000 -101.045 -100.984
##  .intelW2P ~~
##    .intelW3S       -105.554    0.015 -6941.398   0.000 -105.584 -105.525
##  .intelW3S ~~
##    .intelW3P       -113.654    0.023 -4887.992   0.000 -113.699 -113.608
```

```
##    .intelW4P    -115.336    0.015  -7485.934    0.000 -115.366 -115.305
## .intelW1P ~~
##    .intelW4S    -105.068    0.016  -6767.585    0.000 -105.098 -105.037
## .intelW2P ~~
##    .intelW4S    -109.815    0.012  -9036.228    0.000 -109.839 -109.791
## .intelW3P ~~
##    .intelW4S    -115.312    0.023  -5033.405    0.000 -115.357 -115.267
## .intelW4S ~~
##    .intelW4P    -134.479    0.021  -6491.536    0.000 -134.520 -134.439
## .openaW1S ~~
##    .openaW2S       0.330    0.033     10.130    0.000    0.266    0.394
##    .openaW3S       0.325    0.032     10.224    0.000    0.263    0.387
##    .openaW4S       0.319    0.033      9.727    0.000    0.255    0.383
##    .openaW1P       0.163    0.025      6.612    0.000    0.114    0.211
##    .openaW2P       0.182    0.025      7.280    0.000    0.133    0.230
##    .openaW3P       0.196    0.028      7.109    0.000    0.142    0.250
##    .openaW4P       0.178    0.028      6.343    0.000    0.123    0.233
## .openaW2S ~~
##    .openaW3S       0.348    0.034     10.182    0.000    0.281    0.415
##    .openaW4S       0.343    0.035      9.717    0.000    0.273    0.412
## .openaW1P ~~
##    .openaW2S       0.158    0.026      6.087    0.000    0.107    0.208
## .openaW2S ~~
##    .openaW2P       0.177    0.027      6.494    0.000    0.124    0.231
##    .openaW3P       0.195    0.029      6.709    0.000    0.138    0.252
##    .openaW4P       0.181    0.030      6.056    0.000    0.123    0.240
## .openaW3S ~~
##    .openaW4S       0.336    0.035      9.714    0.000    0.268    0.403
## .openaW1P ~~
##    .openaW3S       0.150    0.025      6.008    0.000    0.101    0.199
## .openaW2P ~~
##    .openaW3S       0.164    0.026      6.315    0.000    0.113    0.215
## .openaW3S ~~
##    .openaW3P       0.187    0.028      6.610    0.000    0.132    0.243
##    .openaW4P       0.167    0.029      5.806    0.000    0.111    0.224
## .openaW1P ~~
##    .openaW4S       0.158    0.026      5.957    0.000    0.106    0.209
## .openaW2P ~~
##    .openaW4S       0.178    0.027      6.501    0.000    0.124    0.232
## .openaW3P ~~
##    .openaW4S       0.199    0.030      6.717    0.000    0.141    0.257
## .openaW4S ~~
##    .openaW4P       0.198    0.031      6.336    0.000    0.137    0.260
## .intelW1P ~~
##    .intelW2P    -190.571    0.021  -9203.643    0.000 -190.611 -190.530
##    .intelW3P    -199.840       NA                          NA       NA
##    .intelW4P    -207.828    0.015 -13495.314    0.000 -207.858 -207.797
## .intelW2P ~~
##    .intelW3P    -208.744    0.025  -8354.334    0.000 -208.793 -208.695
##    .intelW4P    -217.188       NA                          NA       NA
## .intelW3P ~~
##    .intelW4P    -228.037    0.015 -14730.101    0.000 -228.068 -228.007
## .openaW1P ~~
##    .openaW2P       0.203    0.025      8.263    0.000    0.155    0.251
```

```
##      .openaW3P              0.218    0.026    8.246    0.000    0.167    0.270
##      .openaW4P              0.230    0.027    8.487    0.000    0.177    0.283
## .openaW2P  ~~
##      .openaW3P              0.246    0.028    8.745    0.000    0.191    0.301
##      .openaW4P              0.236    0.028    8.465    0.000    0.182    0.291
## .openaW3P  ~~
##      .openaW4P              0.274    0.031    8.853    0.000    0.213    0.335
##    Std.lv  Std.all
##
##     0.897    0.897
##
##   -48.505   -0.782
##   -50.880   -0.851
##   -52.931   -0.813
##  -124.251   -1.002
##   -96.368   -0.784
##  -101.045   -0.852
##  -105.114   -0.815
##
##   -53.145   -0.896
##   -55.307   -0.857
##
##   -96.344   -0.784
##
##  -122.180   -1.002
##  -105.552   -0.898
##  -109.836   -0.859
##
##   -58.076   -0.933
##
##  -101.014   -0.852
##
##  -105.554   -0.898
##
##  -113.654   -1.003
##  -115.336   -0.935
##
##  -105.068   -0.815
##
##  -109.815   -0.859
##
##  -115.312   -0.935
##
##  -134.479   -1.002
##
##     0.330    0.818
##     0.325    0.840
##     0.319    0.809
##     0.163    0.505
##     0.182    0.535
##     0.196    0.557
##     0.178    0.512
##
##     0.348    0.871
```

```
##     0.343    0.841
##
##     0.158    0.474
##
##     0.177    0.506
##     0.195    0.537
##     0.181    0.505
##
##     0.336    0.860
##
##     0.150    0.470
##
##     0.164    0.488
##
##     0.187    0.538
##     0.167    0.487
##
##     0.158    0.485
##
##     0.178    0.519
##
##     0.199    0.561
##
##     0.198    0.566
##
##  -190.571   -0.782
##  -199.840   -0.850
##  -207.828   -0.813
##
##  -208.744   -0.896
##  -217.188   -0.857
##
##  -228.037   -0.933
##
##     0.203    0.726
##     0.218    0.755
##     0.230    0.803
##
##     0.246    0.805
##     0.236    0.782
##
##     0.274    0.878
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      interc           3.657    0.032  112.552    0.000    3.593    3.721
##      slope           -0.001    0.001   -1.866    0.062   -0.003    0.000
##    .intelW1S          0.000                               0.000    0.000
##    .intelW2S          0.000                               0.000    0.000
##    .intelW3S          0.000                               0.000    0.000
##    .intelW4S          0.000                               0.000    0.000
##    .openaW1S    (b)   3.800    0.037  102.232    0.000    3.727    3.873
##    .openaW2S    (b)   3.800    0.037  102.232    0.000    3.727    3.873
##    .openaW3S    (b)   3.800    0.037  102.232    0.000    3.727    3.873
```

```
##    .openaW4S  (b)    3.800    0.037  102.232    0.000    3.727    3.873
##    .intelW1P  (c)   -3.258    0.066  -49.564    0.000   -3.387   -3.129
##    .intelW2P  (c)   -3.258    0.066  -49.564    0.000   -3.387   -3.129
##    .intelW3P  (c)   -3.258    0.066  -49.564    0.000   -3.387   -3.129
##    .intelW4P  (c)   -3.258    0.066  -49.564    0.000   -3.387   -3.129
##    .openaW1P  (d)    3.592    0.036  100.226    0.000    3.522    3.662
##    .openaW2P  (d)    3.592    0.036  100.226    0.000    3.522    3.662
##    .openaW3P  (d)    3.592    0.036  100.226    0.000    3.522    3.662
##    .openaW4P  (d)    3.592    0.036  100.226    0.000    3.522    3.662
##    .opend1           0.000                               0.000    0.000
##    .opend2           0.000                               0.000    0.000
##    .opend3           0.000                               0.000    0.000
##    .opend4           0.000                               0.000    0.000
##    Std.lv  Std.all
##    0.535    0.535
##   -0.026   -0.026
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    3.800    6.081
##    3.800    5.886
##    3.800    6.145
##    3.800    6.021
##   -3.258   -5.854
##   -3.258   -6.489
##   -3.258   -5.677
##   -3.258   -5.770
##    3.592    6.977
##    3.592    6.609
##    3.592    6.387
##    3.592    6.465
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##    .intelW1S        -62.545    0.020 -3061.926   0.000  -62.585  -62.505
##    .openaW1S          0.390    0.034    11.508   0.000    0.324    0.457
##    .intelW1P       -245.728    0.010 -25094.945  0.000 -245.747 -245.708
##    .openaW1P          0.265    0.030     8.869   0.000    0.206    0.324
##    .intelW2S        -61.487    0.026 -2378.583   0.000  -61.538  -61.437
##    .openaW2S          0.417    0.039    10.743   0.000    0.341    0.493
##    .intelW2P       -241.610      NA                        NA       NA
##    .openaW2P          0.295    0.031     9.416   0.000    0.234    0.357
##    .intelW3S        -57.183    0.025 -2305.401   0.000  -57.232  -57.134
##    .openaW3S          0.382    0.036    10.671   0.000    0.312    0.453
##    .intelW3P       -224.711      NA                        NA       NA
##    .openaW3P          0.316    0.034     9.232   0.000    0.249    0.383
##    .intelW4S        -67.707    0.020 -3388.325   0.000  -67.746  -67.668
##    .openaW4S          0.398    0.040     9.920   0.000    0.320    0.477
##    .intelW4P       -265.821    0.015 -18176.586  0.000 -265.850 -265.793
```

```
##     .openaW4P          0.309   0.036      8.614   0.000    0.238    0.379
##     .opend1           16.148     NA                                 NA       NA
##     .opend2           10.899   0.015    727.654   0.000   10.870   10.929
##     .opend3            1.445   0.016     91.167   0.000    1.414    1.476
##     .opend4            7.283     NA                                 NA       NA
##     interc            46.696   0.013   3678.942   0.000   46.671   46.721
##     slope              0.003     NA                                 NA       NA
##    Std.lv  Std.all
##  -62.545 -209.055
##    0.390    1.000
## -245.728 -793.202
##    0.265    1.000
##  -61.487 -211.788
##    0.417    1.000
## -241.610 -958.390
##    0.295    1.000
##  -57.183 -191.889
##    0.382    1.000
## -224.711 -682.198
##    0.316    1.000
##  -67.707 -248.837
##    0.398    1.000
## -265.821 -833.797
##    0.309    1.000
##    0.257    0.257
##    0.176    0.176
##    0.025    0.025
##    0.107    0.107
##    1.000    1.000
##    1.000    1.000
```

```r
semPaths(lgmOpend, what = "col", whatLabels = "est", intercepts = T)
```
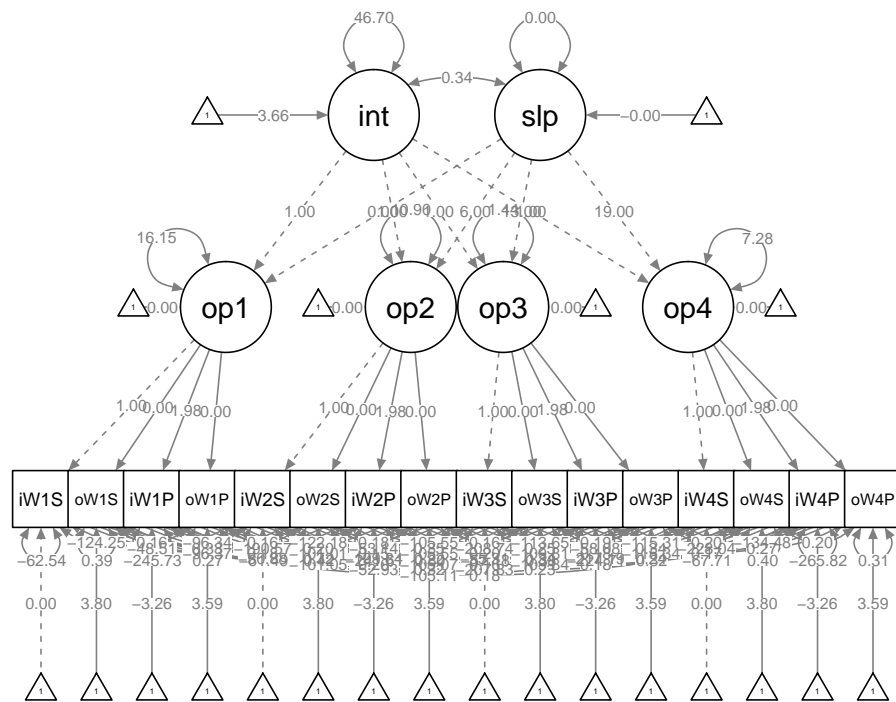
with random parcels

```
lgmOpend <- '

# factor at each time point with same loading
opend1 =~ opendW1S1        + a * opendW1S2 +
          peer * opendW1P1 + aa * opendW1P2

opend2 =~ opendW2S1        + a * opendW2S2 +
          peer * opendW2P1 + aa * opendW2P2

opend3 =~ opendW3S1        + a * opendW3S2 +
          peer * opendW3P1 + aa * opendW3P2

opend4 =~ opendW4S1        + a * opendW4S2 +
          peer * opendW4P1 + aa * opendW4P2

# second order factor for intercept and slope
interc =~ 1*opend1 + 1*opend2 + 1*opend3 + 1*opend4
slope =~ 0*opend1 + 6*opend2 + 13*opend3 + 19*opend4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
```

```
opendW1S1 ~ 0*1
opendW2S1 ~ 0*1
opendW3S1 ~ 0*1
opendW4S1 ~ 0*1

# fix equal intercepts
opendW1S2 ~ b*1
opendW2S2 ~ b*1
opendW3S2 ~ b*1
opendW4S2 ~ b*1


opendW1P1 ~ c*1
opendW2P1 ~ c*1
opendW3P1 ~ c*1
opendW4P1 ~ c*1


opendW1P2 ~ d*1
opendW2P2 ~ d*1
opendW3P2 ~ d*1
opendW4P2 ~ d*1

# error covariance - similar parcels across waves
opendW1S1 ~~ opendW2S1 + opendW3S1 + opendW4S1
opendW2S1 ~~ opendW3S1 + opendW4S1
opendW3S1 ~~ opendW4S1

opendW1S2 ~~ opendW2S2 + opendW3S2 + opendW4S2
opendW2S2 ~~ opendW3S2 + opendW4S2
opendW3S2 ~~ opendW4S2

opendW1P1 ~~ opendW2P1 + opendW3P1 + opendW4P1
opendW2P1 ~~ opendW3P1 + opendW4P1
opendW3P1 ~~ opendW4P1

opendW1P2 ~~ opendW2P2 + opendW3P2 + opendW4P2
opendW2P2 ~~ opendW3P2 + opendW4P2
opendW3P2 ~~ opendW4P2

# error covariance - same method at one wave
opendW1S1 ~~ opendW1S2
opendW1P1 ~~ opendW1P2
opendW2S1 ~~ opendW2S2
opendW2P1 ~~ opendW2P2
opendW3S1 ~~ opendW3S2
opendW3P1 ~~ opendW3P2
opendW4S1 ~~ opendW4S2
opendW4P1 ~~ opendW4P2
'
lgmOpend <- sem(lgmOpend, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
```

```
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!
```

`summary(lgmOpend, fit.measures = T, standardized = T, ci = T)`

```
## lavaan 0.6-7 did NOT end normally after 524 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA

## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge

##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on               Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   opend1 =~
##     opnW1S1          1.000                              1.000    1.000
##     opnW1S2   (a)    0.908       NA                        NA       NA
##     opnW1P1 (peer)   0.952       NA                        NA       NA
##     opnW1P2  (aa)    0.935       NA                        NA       NA
##   opend2 =~
##     opnW2S1          1.000                              1.000    1.000
##     opnW2S2   (a)    0.908       NA                        NA       NA
##     opnW2P1 (peer)   0.952       NA                        NA       NA
##     opnW2P2  (aa)    0.935       NA                        NA       NA
##   opend3 =~
##     opnW3S1          1.000                              1.000    1.000
##     opnW3S2   (a)    0.908       NA                        NA       NA
##     opnW3P1 (peer)   0.952       NA                        NA       NA
##     opnW3P2  (aa)    0.935       NA                        NA       NA
##   opend4 =~
##     opnW4S1          1.000                              1.000    1.000
##     opnW4S2   (a)    0.908       NA                        NA       NA
##     opnW4P1 (peer)   0.952       NA                        NA       NA
##     opnW4P2  (aa)    0.935       NA                        NA       NA
```

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```
##   interc =~
##     opend1              1.000                                      1.000    1.000
##     opend2              1.000                                      1.000    1.000
##     opend3              1.000                                      1.000    1.000
##     opend4              1.000                                      1.000    1.000
##   slope =~
##     opend1              0.000                                      0.000    0.000
##     opend2              6.000                                      6.000    6.000
##     opend3             13.000                                     13.000   13.000
##     opend4             19.000                                     19.000   19.000
##    Std.lv  Std.all
##
##    1.300    0.922
##    1.180    0.935
##    1.238    0.971
##    1.216    0.994
##
##    1.159    0.959
##    1.052    0.957
##    1.103    0.957
##    1.084    0.940
##
##    1.146    0.965
##    1.041    0.952
##    1.091    0.903
##    1.072    0.943
##
##    1.148    0.942
##    1.042    0.952
##    1.093    0.924
##    1.074    0.944
##
##    0.883    0.883
##    0.990    0.990
##    1.001    1.001
##    1.000    1.000
##
##      NA       NA
##      NA       NA
##      NA       NA
##      NA       NA
##
## Covariances:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope               0.001       NA                            NA       NA
##  .opendW1S1 ~~
##    .opendW2S1           0.026       NA                            NA       NA
##    .opendW3S1           0.037       NA                            NA       NA
##    .opendW4S1           0.042       NA                            NA       NA
##  .opendW2S1 ~~
##    .opendW3S1           0.030       NA                            NA       NA
##    .opendW4S1           0.055       NA                            NA       NA
##  .opendW3S1 ~~
```

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```
##    .opendW4S1          0.051       NA                      NA        NA
## .opendW1S2 ~~
##    .opendW2S2          0.065       NA                      NA        NA
##    .opendW3S2          0.061       NA                      NA        NA
##    .opendW4S2          0.021       NA                      NA        NA
## .opendW2S2 ~~
##    .opendW3S2          0.057       NA                      NA        NA
##    .opendW4S2          0.018       NA                      NA        NA
## .opendW3S2 ~~
##    .opendW4S2          0.027       NA                      NA        NA
## .opendW1P1 ~~
##    .opendW2P1          0.022       NA                      NA        NA
##    .opendW3P1          0.085       NA                      NA        NA
##    .opendW4P1          0.053       NA                      NA        NA
## .opendW2P1 ~~
##    .opendW3P1          0.072       NA                      NA        NA
##    .opendW4P1          0.074       NA                      NA        NA
## .opendW3P1 ~~
##    .opendW4P1          0.153       NA                      NA        NA
## .opendW1P2 ~~
##    .opendW2P2          0.063       NA                      NA        NA
##    .opendW3P2          0.060       NA                      NA        NA
##    .opendW4P2          0.059       NA                      NA        NA
## .opendW2P2 ~~
##    .opendW3P2          0.149       NA                      NA        NA
##    .opendW4P2          0.147       NA                      NA        NA
## .opendW3P2 ~~
##    .opendW4P2          0.141       NA                      NA        NA
## .opendW1S1 ~~
##    .opendW1S2          0.158       NA                      NA        NA
## .opendW1P1 ~~
##    .opendW1P2          0.002       NA                      NA        NA
## .opendW2S1 ~~
##    .opendW2S2          0.012       NA                      NA        NA
## .opendW2P1 ~~
##    .opendW2P2          0.000       NA                      NA        NA
## .opendW3S1 ~~
##    .opendW3S2          0.039       NA                      NA        NA
## .opendW3P1 ~~
##    .opendW3P2         -0.000       NA                      NA        NA
## .opendW4S1 ~~
##    .opendW4S2          0.048       NA                      NA        NA
## .opendW4P1 ~~
##    .opendW4P2         -0.000       NA                      NA        NA
##    Std.lv  Std.all
##
##    0.085    0.085
##
##    0.026    0.140
##    0.037    0.220
##    0.042    0.190
##
##    0.030    0.280
##    0.055    0.391
```

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```
##
##     0.051    0.399
##
##     0.065    0.454
##     0.061    0.405
##     0.021    0.143
##
##     0.057    0.529
##     0.018    0.173
##
##     0.027    0.239
##
##     0.022    0.220
##     0.085    0.540
##     0.053    0.388
##
##     0.072    0.413
##     0.074    0.488
##
##     0.153    0.655
##
##     0.063    1.218
##     0.060    1.209
##     0.059    1.206
##
##     0.149    0.998
##     0.147    0.999
##
##     0.141    1.000
##
##     0.158    0.644
##
##     0.002    0.061
##
##     0.012    0.107
##
##     0.000    0.002
##
##     0.039    0.376
##
##    -0.000   -0.000
##
##     0.048    0.350
##
##    -0.000   -0.000
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      interc         3.766      NA                          NA       NA
##      slope          0.000      NA                          NA       NA
##    .opendW1S1       0.000                               0.000    0.000
##    .opendW2S1       0.000                               0.000    0.000
##    .opendW3S1       0.000                               0.000    0.000
##    .opendW4S1       0.000                               0.000    0.000
```

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```
##    .opendW1S2  (b)    0.208      NA                          NA      NA
##    .opendW2S2  (b)    0.208      NA                          NA      NA
##    .opendW3S2  (b)    0.208      NA                          NA      NA
##    .opendW4S2  (b)    0.208      NA                          NA      NA
##    .opendW1P1  (c)    0.171      NA                          NA      NA
##    .opendW2P1  (c)    0.171      NA                          NA      NA
##    .opendW3P1  (c)    0.171      NA                          NA      NA
##    .opendW4P1  (c)    0.171      NA                          NA      NA
##    .opendW1P2  (d)    0.365      NA                          NA      NA
##    .opendW2P2  (d)    0.365      NA                          NA      NA
##    .opendW3P2  (d)    0.365      NA                          NA      NA
##    .opendW4P2  (d)    0.365      NA                          NA      NA
##    .opend1            0.000                          0.000   0.000
##    .opend2            0.000                          0.000   0.000
##    .opend3            0.000                          0.000   0.000
##    .opend4            0.000                          0.000   0.000
##     Std.lv   Std.all
##     3.283    3.283
##        NA       NA
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.208    0.165
##     0.208    0.189
##     0.208    0.191
##     0.208    0.190
##     0.171    0.134
##     0.171    0.148
##     0.171    0.142
##     0.171    0.145
##     0.365    0.298
##     0.365    0.316
##     0.365    0.321
##     0.365    0.321
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .opendW1S1       0.299      NA                          NA      NA
##    .opendW1S2       0.201      NA                          NA      NA
##    .opendW1P1       0.092      NA                          NA      NA
##    .opendW1P2       0.017      NA                          NA      NA
##    .opendW2S1       0.118      NA                          NA      NA
##    .opendW2S2       0.102      NA                          NA      NA
##    .opendW2P1       0.112      NA                          NA      NA
##    .opendW2P2       0.155      NA                          NA      NA
##    .opendW3S1       0.097      NA                          NA      NA
##    .opendW3S2       0.112      NA                          NA      NA
##    .opendW3P1       0.268      NA                          NA      NA
##    .opendW3P2       0.142      NA                          NA      NA
```

```
##     .opendW4S1        0.166      NA                        NA       NA
##     .opendW4S2        0.111      NA                        NA       NA
##     .opendW4P1        0.204      NA                        NA       NA
##     .opendW4P2        0.140      NA                        NA       NA
##     .opend1           0.373      NA                        NA       NA
##     .opend2           0.017      NA                        NA       NA
##     .opend3          -0.007      NA                        NA       NA
##     .opend4           0.014      NA                        NA       NA
##      interc           1.316      NA                        NA       NA
##      slope           -0.000      NA                        NA       NA
##     Std.lv   Std.all
##      0.299     0.150
##      0.201     0.126
##      0.092     0.057
##      0.017     0.012
##      0.118     0.081
##      0.102     0.084
##      0.112     0.084
##      0.155     0.117
##      0.097     0.068
##      0.112     0.094
##      0.268     0.184
##      0.142     0.110
##      0.166     0.112
##      0.111     0.093
##      0.204     0.146
##      0.140     0.108
##      0.221     0.221
##      0.012     0.012
##     -0.006    -0.006
##      0.010     0.010
##      1.000     1.000
##        NA        NA
```

```r
semPaths(lgmOpend, what = "col", whatLabels = "est", intercepts = T)
```
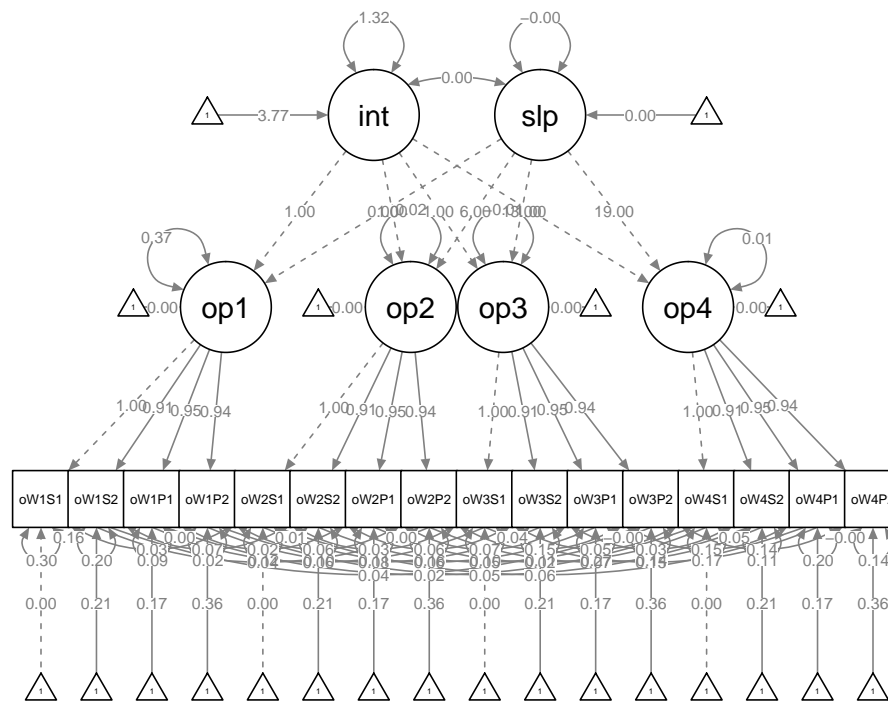
LGM Assertiveness

```
lgmAssert <- '

# factor at each time point with same loading
assert1 =~ assertW1S1        + a * assertW1S2 +
           peer * assertW1P1 + aa * assertW1P2

assert2 =~ assertW2S1        + a * assertW2S2 +
           peer * assertW2P1 + aa * assertW2P2

assert3 =~ assertW3S1        + a * assertW3S2 +
           peer * assertW3P1 + aa * assertW3P2

assert4 =~ assertW4S1        + a * assertW4S2 +
           peer * assertW4P1 + aa * assertW4P2

# second order factor for intercept and slope
interc =~ 1*assert1 + 1*assert2 + 1*assert3 + 1*assert4
slope =~ 0*assert1 + 6*assert2 + 13*assert3 + 19*assert4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
```

```
assertW1S1 ~ 0*1
assertW2S1 ~ 0*1
assertW3S1 ~ 0*1
assertW4S1 ~ 0*1

# fix equal intercepts
assertW1S2 ~ b*1
assertW2S2 ~ b*1
assertW3S2 ~ b*1
assertW4S2 ~ b*1

assertW1P1 ~ c*1
assertW2P1 ~ c*1
assertW3P1 ~ c*1
assertW4P1 ~ c*1

assertW1P2 ~ d*1
assertW2P2 ~ d*1
assertW3P2 ~ d*1
assertW4P2 ~ d*1

# error covariance - similar parcels across waves
assertW1S1 ~~ assertW2S1 + assertW3S1 + assertW4S1
assertW2S1 ~~ assertW3S1 + assertW4S1
assertW3S1 ~~ assertW4S1

assertW1S2 ~~ assertW2S2 + assertW3S2 + assertW4S2
assertW2S2 ~~ assertW3S2 + assertW4S2
assertW3S2 ~~ assertW4S2

assertW1P1 ~~ assertW2P1 + assertW3P1 + assertW4P1
assertW2P1 ~~ assertW3P1 + assertW4P1
assertW3P1 ~~ assertW4P1

assertW1P2 ~~ assertW2P2 + assertW3P2 + assertW4P2
assertW2P2 ~~ assertW3P2 + assertW4P2
assertW3P2 ~~ assertW4P2

# error covariance - same method at one wave
assertW1S1 ~~ assertW1S2
assertW1P1 ~~ assertW1P2
assertW2S1 ~~ assertW2S2
assertW2P1 ~~ assertW2P2
assertW3S1 ~~ assertW3S2
assertW3P1 ~~ assertW3P2
assertW4S1 ~~ assertW4S2
assertW4P1 ~~ assertW4P2
'
lgmAssert <- sem(lgmAssert, data = data, missing = "ML")

## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```r
summary(lgmAssert, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 188 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               299.533
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2668.403
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.917
##   Tucker-Lewis Index (TLI)                       0.889
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1412.291
##   Loglikelihood unrestricted model (H1)      -1262.524
##
##   Akaike (AIC)                                2950.581
##   Bayesian (BIC)                              3174.662
##   Sample-size adjusted Bayesian (BIC)         2974.929
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.096
##   90 Percent confidence interval - lower         0.084
##   90 Percent confidence interval - upper         0.108
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.181
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
```

```
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   assert1 =~
##     assW1S1            1.000                                1.000    1.000
##     assW1S2     (a)    1.066    0.067   15.917    0.000    0.935    1.198
##     assW1P1 (peer)    0.377    0.069    5.478    0.000    0.242    0.512
##     assW1P2    (aa)    0.525    0.073    7.213    0.000    0.382    0.667
##   assert2 =~
##     assW2S1            1.000                                1.000    1.000
##     assW2S2     (a)    1.066    0.067   15.917    0.000    0.935    1.198
##     assW2P1 (peer)    0.377    0.069    5.478    0.000    0.242    0.512
##     assW2P2    (aa)    0.525    0.073    7.213    0.000    0.382    0.667
##   assert3 =~
##     assW3S1            1.000                                1.000    1.000
##     assW3S2     (a)    1.066    0.067   15.917    0.000    0.935    1.198
##     assW3P1 (peer)    0.377    0.069    5.478    0.000    0.242    0.512
##     assW3P2    (aa)    0.525    0.073    7.213    0.000    0.382    0.667
##   assert4 =~
##     assW4S1            1.000                                1.000    1.000
##     assW4S2     (a)    1.066    0.067   15.917    0.000    0.935    1.198
##     assW4P1 (peer)    0.377    0.069    5.478    0.000    0.242    0.512
##     assW4P2    (aa)    0.525    0.073    7.213    0.000    0.382    0.667
##   interc =~
##     assert1            1.000                                1.000    1.000
##     assert2            1.000                                1.000    1.000
##     assert3            1.000                                1.000    1.000
##     assert4            1.000                                1.000    1.000
##   slope =~
##     assert1            0.000                                0.000    0.000
##     assert2            6.000                                6.000    6.000
##     assert3           13.000                               13.000   13.000
##     assert4           19.000                               19.000   19.000
##    Std.lv  Std.all
##
##    0.570    0.825
##    0.608    0.806
##    0.215    0.370
##    0.299    0.476
##
##    0.570    0.810
##    0.608    0.830
##    0.215    0.406
##    0.299    0.483
##
##    0.576    0.845
##    0.614    0.860
##    0.217    0.390
##    0.302    0.441
##
##    0.618    0.890
##    0.659    0.907
##    0.233    0.436
##    0.324    0.507
```

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```
##
##     1.027    1.027
##     1.027    1.027
##     1.017    1.017
##     0.947    0.947
##
##     0.000    0.000
##     0.137    0.137
##     0.295    0.295
##     0.401    0.401
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope            -0.001    0.001   -1.270    0.204   -0.004    0.001
## .assertW1S1 ~~
##     .assertW2S1       0.043    0.021    2.049    0.040    0.002    0.085
##     .assertW3S1       0.035    0.019    1.813    0.070   -0.003    0.073
##     .assertW4S1       0.022    0.019    1.156    0.248   -0.015    0.059
## .assertW2S1 ~~
##     .assertW3S1       0.065    0.021    3.114    0.002    0.024    0.106
##     .assertW4S1       0.055    0.021    2.629    0.009    0.014    0.096
## .assertW3S1 ~~
##     .assertW4S1       0.057    0.020    2.853    0.004    0.018    0.097
## .assertW1S2 ~~
##     .assertW2S2       0.069    0.024    2.900    0.004    0.022    0.116
##     .assertW3S2       0.059    0.022    2.721    0.007    0.016    0.101
##     .assertW4S2       0.054    0.022    2.443    0.015    0.011    0.097
## .assertW2S2 ~~
##     .assertW3S2       0.055    0.022    2.471    0.013    0.011    0.099
##     .assertW4S2       0.070    0.024    2.942    0.003    0.023    0.116
## .assertW3S2 ~~
##     .assertW4S2       0.047    0.023    2.105    0.035    0.003    0.091
## .assertW1P1 ~~
##     .assertW2P1       0.162    0.028    5.830    0.000    0.107    0.216
##     .assertW3P1       0.171    0.032    5.332    0.000    0.108    0.233
##     .assertW4P1       0.137    0.028    4.891    0.000    0.082    0.191
## .assertW2P1 ~~
##     .assertW3P1       0.129    0.029    4.397    0.000    0.071    0.186
##     .assertW4P1       0.133    0.027    4.991    0.000    0.081    0.186
## .assertW3P1 ~~
##     .assertW4P1       0.163    0.032    5.115    0.000    0.100    0.225
## .assertW1P2 ~~
##     .assertW2P2       0.170    0.032    5.262    0.000    0.107    0.233
##     .assertW3P2       0.243    0.038    6.397    0.000    0.169    0.318
##     .assertW4P2       0.208    0.033    6.207    0.000    0.142    0.273
## .assertW2P2 ~~
##     .assertW3P2       0.268    0.040    6.647    0.000    0.189    0.347
##     .assertW4P2       0.219    0.035    6.176    0.000    0.150    0.289
## .assertW3P2 ~~
##     .assertW4P2       0.254    0.042    6.050    0.000    0.171    0.336
## .assertW1S1 ~~
##     .assertW1S2       0.063    0.027    2.329    0.020    0.010    0.117
## .assertW1P1 ~~
```

```
##    .assertW1P2         0.071    0.017    4.227    0.000    0.038    0.103
## .assertW2S1 ~~
##    .assertW2S2         0.041    0.023    1.813    0.070   -0.003    0.086
## .assertW2P1 ~~
##    .assertW2P2         0.057    0.015    3.745    0.000    0.027    0.086
## .assertW3S1 ~~
##    .assertW3S2         0.014    0.019    0.780    0.435   -0.022    0.051
## .assertW3P1 ~~
##    .assertW3P2        -0.003    0.018   -0.186    0.853   -0.038    0.031
## .assertW4S1 ~~
##    .assertW4S2        -0.005    0.031   -0.156    0.876   -0.065    0.056
## .assertW4P1 ~~
##    .assertW4P2         0.040    0.016    2.521    0.012    0.009    0.071
##    Std.lv  Std.all
##
##   -0.193   -0.193
##
##    0.043    0.269
##    0.035    0.245
##    0.022    0.178
##
##    0.065    0.433
##    0.055    0.418
##
##    0.057    0.494
##
##    0.069    0.379
##    0.059    0.362
##    0.054    0.396
##
##    0.055    0.370
##    0.070    0.559
##
##    0.047    0.425
##
##    0.162    0.618
##    0.171    0.615
##    0.137    0.525
##
##    0.129    0.518
##    0.133    0.572
##
##    0.163    0.660
##
##    0.170    0.566
##    0.243    0.715
##    0.208    0.681
##
##    0.268    0.802
##    0.219    0.731
##
##    0.254    0.747
##
##    0.063    0.364
```

```
##
##     0.071    0.236
##
##     0.041    0.245
##
##     0.057    0.215
##
##     0.014    0.109
##
##    -0.003   -0.010
##
##    -0.005   -0.050
##
##     0.040    0.150
##
## Intercepts:
##                      Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##       interc           3.381    0.042   81.208    0.000     3.299     3.462
##       slope           -0.001    0.002   -0.433    0.665    -0.004     0.002
##    .assertW1S1         0.000                                0.000     0.000
##    .assertW2S1         0.000                                0.000     0.000
##    .assertW3S1         0.000                                0.000     0.000
##    .assertW4S1         0.000                                0.000     0.000
##    .assertW1S2 (b)    -0.104    0.227   -0.458    0.647    -0.550     0.342
##    .assertW2S2 (b)    -0.104    0.227   -0.458    0.647    -0.550     0.342
##    .assertW3S2 (b)    -0.104    0.227   -0.458    0.647    -0.550     0.342
##    .assertW4S2 (b)    -0.104    0.227   -0.458    0.647    -0.550     0.342
##    .assertW1P1 (c)     2.429    0.233   10.431    0.000     1.972     2.885
##    .assertW2P1 (c)     2.429    0.233   10.431    0.000     1.972     2.885
##    .assertW3P1 (c)     2.429    0.233   10.431    0.000     1.972     2.885
##    .assertW4P1 (c)     2.429    0.233   10.431    0.000     1.972     2.885
##    .assertW1P2 (d)     1.753    0.248    7.066    0.000     1.266     2.239
##    .assertW2P2 (d)     1.753    0.248    7.066    0.000     1.266     2.239
##    .assertW3P2 (d)     1.753    0.248    7.066    0.000     1.266     2.239
##    .assertW4P2 (d)     1.753    0.248    7.066    0.000     1.266     2.239
##    .assert1            0.000                                0.000     0.000
##    .assert2            0.000                                0.000     0.000
##    .assert3            0.000                                0.000     0.000
##    .assert4            0.000                                0.000     0.000
##     Std.lv   Std.all
##      5.774    5.774
##     -0.053   -0.053
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##     -0.104   -0.138
##     -0.104   -0.142
##     -0.104   -0.146
##     -0.104   -0.143
##      2.429    4.175
##      2.429    4.583
##      2.429    4.361
##      2.429    4.544
```

```
##    1.753    2.787
##    1.753    2.826
##    1.753    2.557
##    1.753    2.738
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##
## Variances:
##                  Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##    .assertW1S1       0.152    0.031    4.922    0.000     0.092     0.213
##    .assertW1S2       0.199    0.040    4.921    0.000     0.120     0.278
##    .assertW1P1       0.292    0.034    8.565    0.000     0.225     0.359
##    .assertW1P2       0.306    0.036    8.524    0.000     0.236     0.376
##    .assertW2S1       0.171    0.033    5.253    0.000     0.107     0.235
##    .assertW2S2       0.167    0.035    4.814    0.000     0.099     0.234
##    .assertW2P1       0.235    0.030    7.894    0.000     0.176     0.293
##    .assertW2P2       0.295    0.037    7.979    0.000     0.223     0.368
##    .assertW3S1       0.133    0.027    4.927    0.000     0.080     0.186
##    .assertW3S2       0.133    0.031    4.287    0.000     0.072     0.194
##    .assertW3P1       0.263    0.037    7.183    0.000     0.191     0.335
##    .assertW3P2       0.378    0.051    7.421    0.000     0.279     0.478
##    .assertW4S1       0.101    0.038    2.649    0.008     0.026     0.175
##    .assertW4S2       0.094    0.042    2.206    0.027     0.010     0.177
##    .assertW4P1       0.231    0.033    6.973    0.000     0.166     0.296
##    .assertW4P2       0.305    0.044    6.956    0.000     0.219     0.390
##    .assert1         -0.018    0.024   -0.727    0.467    -0.066     0.030
##    .assert2         -0.006    0.020   -0.304    0.761    -0.045     0.033
##    .assert3         -0.002    0.016   -0.118    0.906    -0.033     0.029
##    .assert4          0.034    0.029    1.156    0.248    -0.024     0.092
##     interc           0.343    0.043    7.945    0.000     0.258     0.428
##     slope            0.000    0.000    2.488    0.013     0.000     0.000
##    Std.lv  Std.all
##     0.152    0.319
##     0.199    0.350
##     0.292    0.863
##     0.306    0.774
##     0.171    0.345
##     0.167    0.311
##     0.235    0.835
##     0.295    0.767
##     0.133    0.287
##     0.133    0.261
##     0.263    0.848
##     0.378    0.806
##     0.101    0.209
##     0.094    0.177
##     0.231    0.810
##     0.305    0.743
##    -0.055   -0.055
##    -0.018   -0.018
##    -0.006   -0.006
##     0.089    0.089
```

```
##      1.000    1.000
##      1.000    1.000
```

```
semPaths(lgmAssert, what = "col", whatLabels = "est", intercepts = T)
```
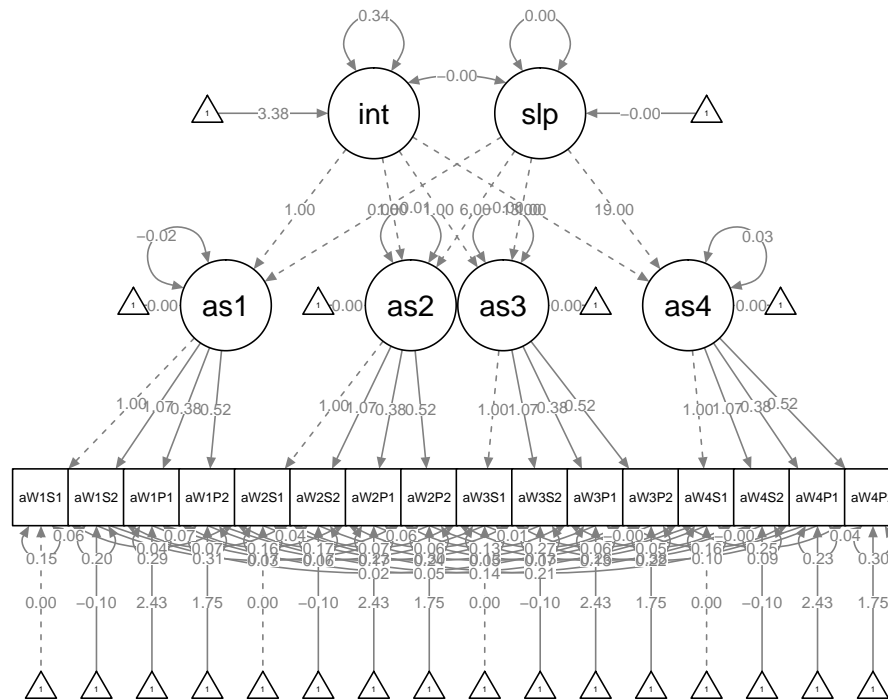

LGM Compassion

```
lgmCompa <- '

# factor at each time point with same loading
compa1 =~ compaW1S1        + a * compaW1S2 +
         peer * compaW1P1 + aa * compaW1P2

compa2 =~ compaW2S1        + a * compaW2S2 +
         peer * compaW2P1 + aa * compaW2P2

compa3 =~ compaW3S1        + a * compaW3S2 +
         peer * compaW3P1 + aa * compaW3P2

compa4 =~ compaW4S1        + a * compaW4S2 +
         peer * compaW4P1 + aa * compaW4P2

# second order factor for intercept and slope
interc =~ 1*compa1 + 1*compa2 + 1*compa3 + 1*compa4
slope =~ 0*compa1 + 6*compa2 + 13*compa3 + 19*compa4
interc ~~ slope
```

```
interc ~ 1
slope ~ 1

# fix zero intercepts
compaW1S1 ~ 0*1
compaW2S1 ~ 0*1
compaW3S1 ~ 0*1
compaW4S1 ~ 0*1

# fix equal intercepts
compaW1S2 ~ b*1
compaW2S2 ~ b*1
compaW3S2 ~ b*1
compaW4S2 ~ b*1


compaW1P1 ~ c*1
compaW2P1 ~ c*1
compaW3P1 ~ c*1
compaW4P1 ~ c*1


compaW1P2 ~ d*1
compaW2P2 ~ d*1
compaW3P2 ~ d*1
compaW4P2 ~ d*1


# error covariance - similar parcels across waves
compaW1S1 ~~ compaW2S1 + compaW3S1 + compaW4S1
compaW2S1 ~~ compaW3S1 + compaW4S1
compaW3S1 ~~ compaW4S1


compaW1S2 ~~ compaW2S2 + compaW3S2 + compaW4S2
compaW2S2 ~~ compaW3S2 + compaW4S2
compaW3S2 ~~ compaW4S2


compaW1P1 ~~ compaW2P1 + compaW3P1 + compaW4P1
compaW2P1 ~~ compaW3P1 + compaW4P1
compaW3P1 ~~ compaW4P1


compaW1P2 ~~ compaW2P2 + compaW3P2 + compaW4P2
compaW2P2 ~~ compaW3P2 + compaW4P2
compaW3P2 ~~ compaW4P2


# error covariance - same method at one wave
compaW1S1 ~~ compaW1S2
compaW1P1 ~~ compaW1P2
compaW2S1 ~~ compaW2S2
compaW2P1 ~~ compaW2P2
compaW3S1 ~~ compaW3S2
compaW3P1 ~~ compaW3P2
compaW4S1 ~~ compaW4S2
compaW4P1 ~~ compaW4P2
'
lgmCompa <- sem(lgmCompa, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```r
summary(lgmCompa, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 180 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               302.256
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2272.548
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.901
##   Tucker-Lewis Index (TLI)                       0.866
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1038.587
##   Loglikelihood unrestricted model (H1)       -887.459
##
##   Akaike (AIC)                                2203.174
##   Bayesian (BIC)                              2427.254
##   Sample-size adjusted Bayesian (BIC)         2227.521
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.096
##   90 Percent confidence interval - lower         0.084
##   90 Percent confidence interval - upper         0.108
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.180
##
## Parameter Estimates:
##
##   Standard errors                             Standard
```

```
##    Information                                    Observed
##    Observed information based on                  Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   compa1 =~
##     cmpW1S1              1.000                                   1.000    1.000
##     cmpW1S2     (a)      1.092    0.057   19.068    0.000   0.980    1.205
##     cmpW1P1 (peer)       1.014    0.136    7.451    0.000   0.748    1.281
##     cmpW1P2    (aa)      0.977    0.133    7.369    0.000   0.718    1.237
##   compa2 =~
##     cmpW2S1              1.000                                   1.000    1.000
##     cmpW2S2     (a)      1.092    0.057   19.068    0.000   0.980    1.205
##     cmpW2P1 (peer)       1.014    0.136    7.451    0.000   0.748    1.281
##     cmpW2P2    (aa)      0.977    0.133    7.369    0.000   0.718    1.237
##   compa3 =~
##     cmpW3S1              1.000                                   1.000    1.000
##     cmpW3S2     (a)      1.092    0.057   19.068    0.000   0.980    1.205
##     cmpW3P1 (peer)       1.014    0.136    7.451    0.000   0.748    1.281
##     cmpW3P2    (aa)      0.977    0.133    7.369    0.000   0.718    1.237
##   compa4 =~
##     cmpW4S1              1.000                                   1.000    1.000
##     cmpW4S2     (a)      1.092    0.057   19.068    0.000   0.980    1.205
##     cmpW4P1 (peer)       1.014    0.136    7.451    0.000   0.748    1.281
##     cmpW4P2    (aa)      0.977    0.133    7.369    0.000   0.718    1.237
##   interc =~
##     compa1              1.000                                   1.000    1.000
##     compa2              1.000                                   1.000    1.000
##     compa3              1.000                                   1.000    1.000
##     compa4              1.000                                   1.000    1.000
##   slope =~
##     compa1              0.000                                   0.000    0.000
##     compa2              6.000                                   6.000    6.000
##     compa3             13.000                                  13.000   13.000
##     compa4             19.000                                  19.000   19.000
##    Std.lv  Std.all
##
##    0.258    0.524
##    0.281    0.530
##    0.261    0.426
##    0.252    0.452
##
##    0.280    0.581
##    0.305    0.594
##    0.284    0.502
##    0.273    0.460
##
##    0.304    0.620
##    0.333    0.635
##    0.309    0.537
##    0.298    0.559
##
##    0.305    0.628
##    0.333    0.626
```

```
##     0.309    0.500
##     0.298    0.492
##
##     1.302    1.302
##     1.199    1.199
##     1.102    1.102
##     1.101    1.101
##
##     0.000    0.000
##     0.209    0.209
##     0.417    0.417
##     0.608    0.608
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    interc ~~
##      slope            0.000    0.001    0.571    0.568   -0.001    0.002
##  .compaW1S1 ~~
##    .compaW2S1        -0.004    0.009   -0.472    0.637   -0.021    0.013
##    .compaW3S1         0.006    0.008    0.698    0.485   -0.011    0.022
##    .compaW4S1         0.008    0.008    1.127    0.260   -0.006    0.023
##  .compaW2S1 ~~
##    .compaW3S1         0.026    0.009    2.812    0.005    0.008    0.044
##    .compaW4S1         0.020    0.008    2.414    0.016    0.004    0.036
##  .compaW3S1 ~~
##    .compaW4S1         0.022    0.008    2.657    0.008    0.006    0.038
##  .compaW1S2 ~~
##    .compaW2S2         0.022    0.010    2.253    0.024    0.003    0.041
##    .compaW3S2         0.016    0.009    1.720    0.086   -0.002    0.033
##    .compaW4S2        -0.003    0.008   -0.335    0.738   -0.019    0.014
##  .compaW2S2 ~~
##    .compaW3S2         0.031    0.010    3.101    0.002    0.011    0.051
##    .compaW4S2         0.026    0.009    2.899    0.004    0.008    0.044
##  .compaW3S2 ~~
##    .compaW4S2         0.017    0.009    1.871    0.061   -0.001    0.034
##  .compaW1P1 ~~
##    .compaW2P1         0.000    0.013    0.003    0.997   -0.026    0.026
##    .compaW3P1         0.000    0.016    0.018    0.986   -0.031    0.032
##    .compaW4P1         0.010    0.015    0.684    0.494   -0.019    0.040
##  .compaW2P1 ~~
##    .compaW3P1         0.024    0.013    1.899    0.058   -0.001    0.050
##    .compaW4P1         0.021    0.013    1.576    0.115   -0.005    0.047
##  .compaW3P1 ~~
##    .compaW4P1         0.005    0.017    0.313    0.754   -0.029    0.039
##  .compaW1P2 ~~
##    .compaW2P2         0.025    0.013    1.880    0.060   -0.001    0.050
##    .compaW3P2         0.036    0.012    2.948    0.003    0.012    0.060
##    .compaW4P2         0.019    0.015    1.256    0.209   -0.011    0.050
##  .compaW2P2 ~~
##    .compaW3P2         0.001    0.012    0.052    0.959   -0.024    0.025
##    .compaW4P2        -0.005    0.014   -0.319    0.750   -0.032    0.023
##  .compaW3P2 ~~
##    .compaW4P2         0.025    0.013    1.978    0.048    0.000    0.050
##  .compaW1S1 ~~
```

```
##     .compaW1S2              0.125    0.021    5.867    0.000    0.083    0.167
## .compaW1P1 ~~
##     .compaW1P2              0.201    0.033    6.110    0.000    0.137    0.266
## .compaW2S1 ~~
##     .compaW2S2              0.088    0.018    4.830    0.000    0.052    0.123
## .compaW2P1 ~~
##     .compaW2P2              0.209    0.033    6.417    0.000    0.145    0.273
## .compaW3S1 ~~
##     .compaW3S2              0.089    0.017    5.351    0.000    0.056    0.122
## .compaW3P1 ~~
##     .compaW3P2              0.143    0.027    5.334    0.000    0.091    0.196
## .compaW4S1 ~~
##     .compaW4S2              0.116    0.024    4.833    0.000    0.069    0.163
## .compaW4P1 ~~
##     .compaW4P2              0.242    0.043    5.608    0.000    0.157    0.327
##    Std.lv  Std.all
##
##    0.104    0.104
##
##   -0.004   -0.025
##    0.006    0.036
##    0.008    0.054
##
##    0.026    0.172
##    0.020    0.133
##
##    0.022    0.152
##
##    0.022    0.117
##    0.016    0.085
##   -0.003   -0.015
##
##    0.031    0.186
##    0.026    0.152
##
##    0.017    0.099
##
##    0.000    0.000
##    0.000    0.001
##    0.010    0.035
##
##    0.024    0.103
##    0.021    0.080
##
##    0.005    0.021
##
##    0.025    0.094
##    0.036    0.164
##    0.019    0.074
##
##    0.001    0.003
##   -0.005   -0.016
##
##    0.025    0.108
```

```
##
##     0.125    0.663
##
##     0.201    0.727
##
##     0.088    0.541
##
##     0.209    0.810
##
##     0.089    0.572
##
##     0.143    0.669
##
##     0.116    0.742
##
##     0.242    0.859
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     interc            4.191    0.027  157.851    0.000     4.139     4.243
##     slope             0.001    0.001    0.782    0.434    -0.002     0.004
##   .compaW1S1          0.000                                0.000     0.000
##   .compaW2S1          0.000                                0.000     0.000
##   .compaW3S1          0.000                                0.000     0.000
##   .compaW4S1          0.000                                0.000     0.000
##   .compaW1S2  (b)    -0.486    0.241   -2.016    0.044    -0.958    -0.014
##   .compaW2S2  (b)    -0.486    0.241   -2.016    0.044    -0.958    -0.014
##   .compaW3S2  (b)    -0.486    0.241   -2.016    0.044    -0.958    -0.014
##   .compaW4S2  (b)    -0.486    0.241   -2.016    0.044    -0.958    -0.014
##   .compaW1P1  (c)    -0.330    0.575   -0.574    0.566    -1.457     0.797
##   .compaW2P1  (c)    -0.330    0.575   -0.574    0.566    -1.457     0.797
##   .compaW3P1  (c)    -0.330    0.575   -0.574    0.566    -1.457     0.797
##   .compaW4P1  (c)    -0.330    0.575   -0.574    0.566    -1.457     0.797
##   .compaW1P2  (d)    -0.116    0.560   -0.207    0.836    -1.214     0.983
##   .compaW2P2  (d)    -0.116    0.560   -0.207    0.836    -1.214     0.983
##   .compaW3P2  (d)    -0.116    0.560   -0.207    0.836    -1.214     0.983
##   .compaW4P2  (d)    -0.116    0.560   -0.207    0.836    -1.214     0.983
##   .compa1             0.000                                0.000     0.000
##   .compa2             0.000                                0.000     0.000
##   .compa3             0.000                                0.000     0.000
##   .compa4             0.000                                0.000     0.000
##    Std.lv   Std.all
##    12.500    12.500
##     0.106     0.106
##     0.000     0.000
##     0.000     0.000
##     0.000     0.000
##     0.000     0.000
##    -0.486    -0.915
##    -0.486    -0.944
##    -0.486    -0.928
##    -0.486    -0.914
##    -0.330    -0.537
##    -0.330    -0.584
```

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```
##    -0.330   -0.574
##    -0.330   -0.534
##    -0.116   -0.208
##    -0.116   -0.195
##    -0.116   -0.218
##    -0.116   -0.191
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .compaW1S1       0.176    0.022    7.992    0.000    0.133    0.219
##    .compaW1S2       0.203    0.024    8.349    0.000    0.155    0.250
##    .compaW1P1       0.309    0.041    7.552    0.000    0.229    0.389
##    .compaW1P2       0.247    0.031    8.062    0.000    0.187    0.308
##    .compaW2S1       0.153    0.019    7.987    0.000    0.116    0.191
##    .compaW2S2       0.171    0.021    8.044    0.000    0.130    0.213
##    .compaW2P1       0.239    0.032    7.377    0.000    0.175    0.302
##    .compaW2P2       0.279    0.037    7.559    0.000    0.206    0.351
##    .compaW3S1       0.148    0.018    8.390    0.000    0.114    0.183
##    .compaW3S2       0.163    0.020    8.336    0.000    0.125    0.202
##    .compaW3P1       0.235    0.032    7.294    0.000    0.172    0.298
##    .compaW3P2       0.195    0.026    7.426    0.000    0.143    0.246
##    .compaW4S1       0.142    0.023    6.280    0.000    0.098    0.187
##    .compaW4S2       0.172    0.028    6.240    0.000    0.118    0.226
##    .compaW4P1       0.286    0.046    6.180    0.000    0.195    0.377
##    .compaW4P2       0.277    0.043    6.422    0.000    0.193    0.362
##    .compa1         -0.046    0.016   -2.916    0.004   -0.077   -0.015
##    .compa2         -0.042    0.013   -3.284    0.001   -0.067   -0.017
##    .compa3         -0.045    0.011   -3.995    0.000   -0.067   -0.023
##    .compa4         -0.067    0.019   -3.570    0.000   -0.104   -0.030
##     interc          0.112    0.017    6.487    0.000    0.078    0.146
##     slope           0.000    0.000    1.890    0.059   -0.000    0.000
##    Std.lv  Std.all
##     0.176    0.726
##     0.203    0.719
##     0.309    0.819
##     0.247    0.796
##     0.153    0.663
##     0.171    0.648
##     0.239    0.748
##     0.279    0.789
##     0.148    0.615
##     0.163    0.596
##     0.235    0.711
##     0.195    0.688
##     0.142    0.606
##     0.172    0.608
##     0.286    0.750
##     0.277    0.758
##    -0.694   -0.694
##    -0.535   -0.535
```

```
##     -0.482    -0.482
##     -0.721    -0.721
##      1.000     1.000
##      1.000     1.000
```

```
semPaths(lgmCompa, what = "col", whatLabels = "est", intercepts = T)
```
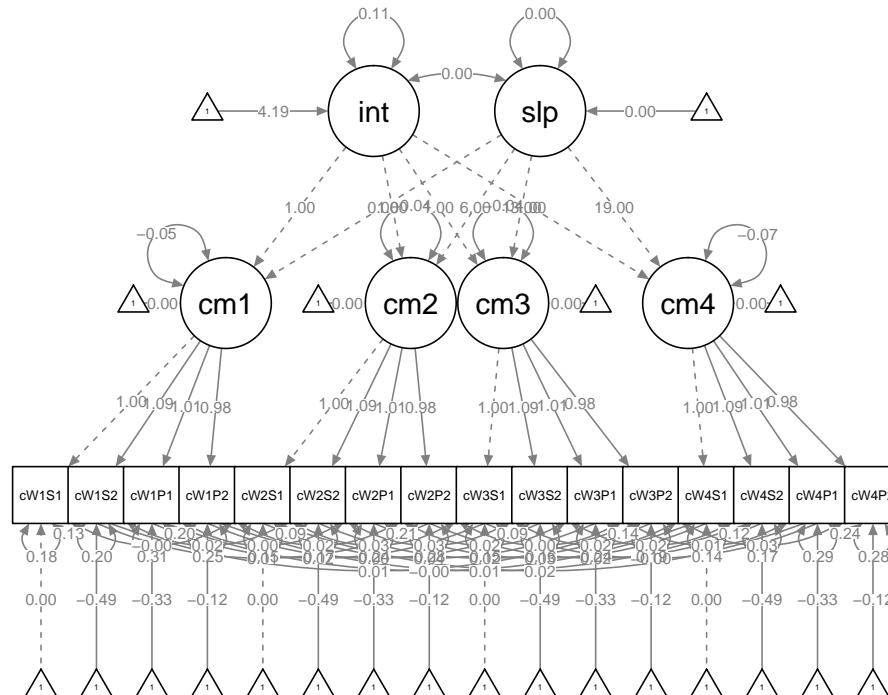

LGM Enthusiasm

```
lgmEnthu <- '

# factor at each time point with same loading
enthu1 =~ enthuW1S1        + a * enthuW1S2 +
          peer * enthuW1P1 + aa * enthuW1P2

enthu2 =~ enthuW2S1        + a * enthuW2S2 +
          peer * enthuW2P1 + aa * enthuW2P2

enthu3 =~ enthuW3S1        + a * enthuW3S2 +
          peer * enthuW3P1 + aa * enthuW3P2

enthu4 =~ enthuW4S1        + a * enthuW4S2 +
          peer * enthuW4P1 + aa * enthuW4P2

# second order factor for intercept and slope
interc =~ 1*enthu1 + 1*enthu2 + 1*enthu3 + 1*enthu4
```

```
slope =~ 0*enthu1 + 6*enthu2 + 13*enthu3 + 19*enthu4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
enthuW1S1 ~ 0*1
enthuW2S1 ~ 0*1
enthuW3S1 ~ 0*1
enthuW4S1 ~ 0*1

# fix equal intercepts
enthuW1S2 ~ b*1
enthuW2S2 ~ b*1
enthuW3S2 ~ b*1
enthuW4S2 ~ b*1

enthuW1P1 ~ c*1
enthuW2P1 ~ c*1
enthuW3P1 ~ c*1
enthuW4P1 ~ c*1

enthuW1P2 ~ d*1
enthuW2P2 ~ d*1
enthuW3P2 ~ d*1
enthuW4P2 ~ d*1

# error covariance - similar parcels across waves
enthuW1S1 ~~ enthuW2S1 + enthuW3S1 + enthuW4S1
enthuW2S1 ~~ enthuW3S1 + enthuW4S1
enthuW3S1 ~~ enthuW4S1

enthuW1S2 ~~ enthuW2S2 + enthuW3S2 + enthuW4S2
enthuW2S2 ~~ enthuW3S2 + enthuW4S2
enthuW3S2 ~~ enthuW4S2

enthuW1P1 ~~ enthuW2P1 + enthuW3P1 + enthuW4P1
enthuW2P1 ~~ enthuW3P1 + enthuW4P1
enthuW3P1 ~~ enthuW4P1

enthuW1P2 ~~ enthuW2P2 + enthuW3P2 + enthuW4P2
enthuW2P2 ~~ enthuW3P2 + enthuW4P2
enthuW3P2 ~~ enthuW4P2

# error covariance - same method at one wave
enthuW1S1 ~~ enthuW1S2
enthuW1P1 ~~ enthuW1P2
enthuW2S1 ~~ enthuW2S2
enthuW2P1 ~~ enthuW2P2
enthuW3S1 ~~ enthuW3S2
enthuW3P1 ~~ enthuW3P2
enthuW4S1 ~~ enthuW4S2
enthuW4P1 ~~ enthuW4P2
```

```
'
lgmEnthu <- sem(lgmEnthu, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, : lavaan WARNING: the
##                   but not all elements of the gradient are (near) zero;
##                   the optimizer may not have found a local solution
##                   use check.gradient = FALSE to skip this check.
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lgmEnthu, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 246 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               244.983
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2328.338
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.929
##   Tucker-Lewis Index (TLI)                       0.905
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1513.362
##   Loglikelihood unrestricted model (H1)      -1390.870
##
##   Akaike (AIC)                                3152.724
##   Bayesian (BIC)                              3376.804
##   Sample-size adjusted Bayesian (BIC)         3177.071
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.082
##   90 Percent confidence interval - lower         0.070
##   90 Percent confidence interval - upper         0.095
##   P-value RMSEA <= 0.05                          0.000
```

```
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                        0.146
##
## Parameter Estimates:
##
##    Standard errors                          Standard
##    Information                              Observed
##    Observed information based on             Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   enthu1 =~
##     entW1S1           1.000                                1.000    1.000
##     entW1S2    (a)    1.194    0.141    8.494    0.000    0.918    1.469
##     entW1P1 (peer)    1.461    0.252    5.795    0.000    0.967    1.955
##     entW1P2   (aa)    1.244    0.216    5.754    0.000    0.820    1.668
##   enthu2 =~
##     entW2S1           1.000                                1.000    1.000
##     entW2S2    (a)    1.194    0.141    8.494    0.000    0.918    1.469
##     entW2P1 (peer)    1.461    0.252    5.795    0.000    0.967    1.955
##     entW2P2   (aa)    1.244    0.216    5.754    0.000    0.820    1.668
##   enthu3 =~
##     entW3S1           1.000                                1.000    1.000
##     entW3S2    (a)    1.194    0.141    8.494    0.000    0.918    1.469
##     entW3P1 (peer)    1.461    0.252    5.795    0.000    0.967    1.955
##     entW3P2   (aa)    1.244    0.216    5.754    0.000    0.820    1.668
##   enthu4 =~
##     entW4S1           1.000                                1.000    1.000
##     entW4S2    (a)    1.194    0.141    8.494    0.000    0.918    1.469
##     entW4P1 (peer)    1.461    0.252    5.795    0.000    0.967    1.955
##     entW4P2   (aa)    1.244    0.216    5.754    0.000    0.820    1.668
##   interc =~
##     enthu1            1.000                                1.000    1.000
##     enthu2            1.000                                1.000    1.000
##     enthu3            1.000                                1.000    1.000
##     enthu4            1.000                                1.000    1.000
##   slope =~
##     enthu1            0.000                                0.000    0.000
##     enthu2            6.000                                6.000    6.000
##     enthu3           13.000                               13.000   13.000
##     enthu4           19.000                               19.000   19.000
##    Std.lv  Std.all
##
##    0.380    0.590
##    0.454    0.617
##    0.555    0.813
##    0.473    0.762
##
##    0.347    0.552
##    0.414    0.575
##    0.506    0.776
##    0.431    0.741
```

```
##
##      0.325     0.532
##      0.387     0.539
##      0.474     0.776
##      0.404     0.717
##
##      0.315     0.523
##      0.376     0.524
##      0.460     0.747
##      0.392     0.700
##
##      1.020     1.020
##      1.118     1.118
##      1.194     1.194
##      1.231     1.231
##
##      0.000     0.000
##      0.156     0.156
##      0.362     0.362
##      0.545     0.545
##
## Covariances:
##                     Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##   interc ~~
##     slope             -0.002    0.001   -2.625    0.009    -0.003   -0.000
##  .enthuW1S1 ~~
##    .enthuW2S1          0.156    0.028    5.572    0.000     0.101    0.211
##    .enthuW3S1          0.142    0.028    5.140    0.000     0.088    0.196
##    .enthuW4S1          0.128    0.027    4.722    0.000     0.075    0.181
##  .enthuW2S1 ~~
##    .enthuW3S1          0.146    0.032    4.580    0.000     0.084    0.209
##    .enthuW4S1          0.162    0.032    5.025    0.000     0.099    0.226
##  .enthuW3S1 ~~
##    .enthuW4S1          0.157    0.034    4.615    0.000     0.090    0.223
##  .enthuW1S2 ~~
##    .enthuW2S2          0.173    0.035    4.875    0.000     0.103    0.242
##    .enthuW3S2          0.149    0.036    4.192    0.000     0.080    0.219
##    .enthuW4S2          0.166    0.036    4.648    0.000     0.096    0.235
##  .enthuW2S2 ~~
##    .enthuW3S2          0.223    0.042    5.256    0.000     0.140    0.306
##    .enthuW4S2          0.232    0.042    5.513    0.000     0.150    0.315
##  .enthuW3S2 ~~
##    .enthuW4S2          0.239    0.043    5.519    0.000     0.154    0.323
##  .enthuW1P1 ~~
##    .enthuW2P1          0.046    0.022    2.080    0.038     0.003    0.090
##    .enthuW3P1          0.036    0.022    1.658    0.097    -0.007    0.078
##    .enthuW4P1          0.043    0.021    2.074    0.038     0.002    0.084
##  .enthuW2P1 ~~
##    .enthuW3P1          0.051    0.022    2.324    0.020     0.008    0.095
##    .enthuW4P1          0.030    0.025    1.196    0.232    -0.019    0.078
##  .enthuW3P1 ~~
##    .enthuW4P1          0.040    0.023    1.755    0.079    -0.005    0.085
##  .enthuW1P2 ~~
##    .enthuW2P2          0.054    0.017    3.186    0.001     0.021    0.087
```

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```
##    .enthuW3P2        0.067   0.017   3.991   0.000   0.034   0.101
##    .enthuW4P2        0.037   0.018   2.034   0.042   0.001   0.073
## .enthuW2P2 ~~
##    .enthuW3P2        0.046   0.018   2.479   0.013   0.010   0.082
##    .enthuW4P2        0.025   0.018   1.352   0.176  -0.011   0.061
## .enthuW3P2 ~~
##    .enthuW4P2        0.044   0.020   2.254   0.024   0.006   0.082
## .enthuW1S1 ~~
##    .enthuW1S2        0.088   0.018   4.862   0.000   0.053   0.123
## .enthuW1P1 ~~
##    .enthuW1P2        0.053   0.022   2.367   0.018   0.009   0.097
## .enthuW2S1 ~~
##    .enthuW2S2        0.044   0.017   2.658   0.008   0.012   0.077
## .enthuW2P1 ~~
##    .enthuW2P2        0.060   0.021   2.853   0.004   0.019   0.102
## .enthuW3S1 ~~
##    .enthuW3S2        0.055   0.019   2.824   0.005   0.017   0.093
## .enthuW3P1 ~~
##    .enthuW3P2        0.060   0.023   2.537   0.011   0.014   0.106
## .enthuW4S1 ~~
##    .enthuW4S2        0.064   0.019   3.366   0.001   0.027   0.102
## .enthuW4P1 ~~
##    .enthuW4P2        0.074   0.030   2.511   0.012   0.016   0.132
##    Std.lv  Std.all
##
##   -0.509   -0.509
##
##    0.156    0.573
##    0.142    0.529
##    0.128    0.479
##
##    0.146    0.541
##    0.162    0.604
##
##    0.157    0.589
##
##    0.173    0.507
##    0.149    0.426
##    0.166    0.468
##
##    0.223    0.625
##    0.232    0.646
##
##    0.239    0.645
##
##    0.046    0.281
##    0.036    0.233
##    0.043    0.267
##
##    0.051    0.323
##    0.030    0.176
##
##    0.040    0.256
##
```

```
##    0.054    0.343
##    0.067    0.427
##    0.037    0.233
##
##    0.046    0.297
##    0.025    0.160
##
##    0.044    0.280
##
##    0.088    0.292
##
##    0.053    0.332
##
##    0.044    0.144
##
##    0.060    0.374
##
##    0.055    0.175
##
##    0.060    0.394
##
##    0.064    0.205
##
##    0.074    0.454
##
## Intercepts:
##                      Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      interc             3.891    0.038  103.250    0.000    3.817    3.965
##      slope             -0.000    0.001   -0.257    0.797   -0.003    0.002
##    .enthuW1S1           0.000                               0.000    0.000
##    .enthuW2S1           0.000                               0.000    0.000
##    .enthuW3S1           0.000                               0.000    0.000
##    .enthuW4S1           0.000                               0.000    0.000
##    .enthuW1S2  (b)     -1.125    0.549   -2.047    0.041   -2.201   -0.048
##    .enthuW2S2  (b)     -1.125    0.549   -2.047    0.041   -2.201   -0.048
##    .enthuW3S2  (b)     -1.125    0.549   -2.047    0.041   -2.201   -0.048
##    .enthuW4S2  (b)     -1.125    0.549   -2.047    0.041   -2.201   -0.048
##    .enthuW1P1  (c)     -1.977    0.984   -2.009    0.045   -3.906   -0.048
##    .enthuW2P1  (c)     -1.977    0.984   -2.009    0.045   -3.906   -0.048
##    .enthuW3P1  (c)     -1.977    0.984   -2.009    0.045   -3.906   -0.048
##    .enthuW4P1  (c)     -1.977    0.984   -2.009    0.045   -3.906   -0.048
##    .enthuW1P2  (d)     -0.880    0.844   -1.044    0.297   -2.534    0.773
##    .enthuW2P2  (d)     -0.880    0.844   -1.044    0.297   -2.534    0.773
##    .enthuW3P2  (d)     -0.880    0.844   -1.044    0.297   -2.534    0.773
##    .enthuW4P2  (d)     -0.880    0.844   -1.044    0.297   -2.534    0.773
##    .enthu1              0.000                               0.000    0.000
##    .enthu2              0.000                               0.000    0.000
##    .enthu3              0.000                               0.000    0.000
##    .enthu4              0.000                               0.000    0.000
##    Std.lv   Std.all
##   10.042   10.042
##   -0.034   -0.034
##    0.000    0.000
##    0.000    0.000
```

```
##      0.000     0.000
##      0.000     0.000
##     -1.125    -1.528
##     -1.125    -1.563
##     -1.125    -1.564
##     -1.125    -1.569
##     -1.977    -2.896
##     -1.977    -3.029
##     -1.977    -3.237
##     -1.977    -3.214
##     -0.880    -1.419
##     -0.880    -1.513
##     -0.880    -1.563
##     -0.880    -1.574
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .enthuW1S1        0.270    0.027    9.927    0.000    0.216    0.323
##     .enthuW1S2        0.336    0.038    8.874    0.000    0.261    0.410
##     .enthuW1P1        0.158    0.036    4.346    0.000    0.087    0.229
##     .enthuW1P2        0.161    0.027    5.948    0.000    0.108    0.214
##     .enthuW2S1        0.274    0.033    8.414    0.000    0.210    0.337
##     .enthuW2S2        0.347    0.042    8.242    0.000    0.264    0.429
##     .enthuW2P1        0.170    0.033    5.201    0.000    0.106    0.234
##     .enthuW2P2        0.153    0.027    5.688    0.000    0.100    0.205
##     .enthuW3S1        0.267    0.033    8.059    0.000    0.202    0.332
##     .enthuW3S2        0.367    0.042    8.712    0.000    0.284    0.450
##     .enthuW3P1        0.148    0.036    4.107    0.000    0.078    0.219
##     .enthuW3P2        0.154    0.027    5.765    0.000    0.102    0.207
##     .enthuW4S1        0.264    0.035    7.501    0.000    0.195    0.333
##     .enthuW4S2        0.373    0.046    8.038    0.000    0.282    0.464
##     .enthuW4P1        0.167    0.037    4.547    0.000    0.095    0.239
##     .enthuW4P2        0.160    0.036    4.493    0.000    0.090    0.229
##     .enthu1          -0.006    0.009   -0.623    0.533   -0.024    0.012
##     .enthu2          -0.012    0.008   -1.362    0.173   -0.028    0.005
##     .enthu3          -0.012    0.011   -1.162    0.245   -0.033    0.008
##     .enthu4          -0.013    0.010   -1.276    0.202   -0.033    0.007
##      interc           0.150    0.039    3.878    0.000    0.074    0.226
##      slope            0.000    0.000    1.994    0.046    0.000    0.000
##     Std.lv   Std.all
##      0.270     0.651
##      0.336     0.620
##      0.158     0.339
##      0.161     0.419
##      0.274     0.695
##      0.347     0.669
##      0.170     0.398
##      0.153     0.451
##      0.267     0.717
##      0.367     0.710
```

```
##      0.148      0.397
##      0.154      0.486
##      0.264      0.727
##      0.373      0.725
##      0.167      0.441
##      0.160      0.510
##     -0.040     -0.040
##     -0.096     -0.096
##     -0.117     -0.117
##     -0.130     -0.130
##      1.000      1.000
##      1.000      1.000
```

```r
semPaths(lgmEnthu, what = "col", whatLabels = "est", intercepts = T)
```
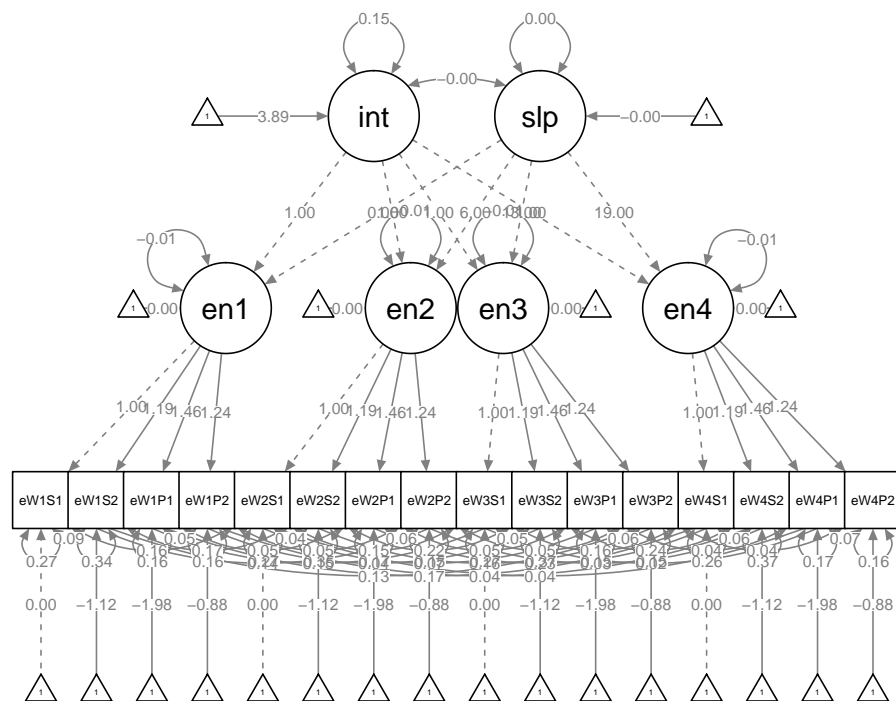

LGM Industriousness

```r
lgmIndus <- '

# factor at each time point with same loading
indus1 =~ indusW1S1         + a * indusW1S2 +
          peer * indusW1P1 + aa * indusW1P2

indus2 =~ indusW2S1         + a * indusW2S2 +
          peer * indusW2P1 + aa * indusW2P2
```

```
indus3 =~ indusW3S1        + a * indusW3S2 +
           peer * indusW3P1 + aa * indusW3P2


indus4 =~ indusW4S1        + a * indusW4S2 +
           peer * indusW4P1 + aa * indusW4P2


# second order factor for intercept and slope
interc =~ 1*indus1 + 1*indus2 + 1*indus3 + 1*indus4
slope =~ 0*indus1 + 6*indus2 + 13*indus3 + 19*indus4
interc ~~ slope
interc ~ 1
slope ~ 1


# fix zero intercepts
indusW1S1 ~ 0*1
indusW2S1 ~ 0*1
indusW3S1 ~ 0*1
indusW4S1 ~ 0*1


# fix equal intercepts
indusW1S2 ~ b*1
indusW2S2 ~ b*1
indusW3S2 ~ b*1
indusW4S2 ~ b*1


indusW1P1 ~ c*1
indusW2P1 ~ c*1
indusW3P1 ~ c*1
indusW4P1 ~ c*1


indusW1P2 ~ d*1
indusW2P2 ~ d*1
indusW3P2 ~ d*1
indusW4P2 ~ d*1

# error covariance - similar parcels across waves
indusW1S1 ~~ indusW2S1 + indusW3S1 + indusW4S1
indusW2S1 ~~ indusW3S1 + indusW4S1
indusW3S1 ~~ indusW4S1

indusW1S2 ~~ indusW2S2 + indusW3S2 + indusW4S2
indusW2S2 ~~ indusW3S2 + indusW4S2
indusW3S2 ~~ indusW4S2

indusW1P1 ~~ indusW2P1 + indusW3P1 + indusW4P1
indusW2P1 ~~ indusW3P1 + indusW4P1
indusW3P1 ~~ indusW4P1

indusW1P2 ~~ indusW2P2 + indusW3P2 + indusW4P2
indusW2P2 ~~ indusW3P2 + indusW4P2
indusW3P2 ~~ indusW4P2

# error covariance - same method at one wave
```

```
indusW1S1 ~~ indusW1S2
indusW1P1 ~~ indusW1P2
indusW2S1 ~~ indusW2S2
indusW2P1 ~~ indusW2P2
indusW3S1 ~~ indusW3S2
indusW3P1 ~~ indusW3P2
indusW4S1 ~~ indusW4S2
indusW4P1 ~~ indusW4P2
'
lgmIndus <- sem(lgmIndus, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lgmIndus, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 197 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               245.959
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              1960.526
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.915
##   Tucker-Lewis Index (TLI)                       0.885
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1638.292
##   Loglikelihood unrestricted model (H1)      -1515.313
##
##   Akaike (AIC)                                3402.585
##   Bayesian (BIC)                              3626.665
##   Sample-size adjusted Bayesian (BIC)         3426.932
##
## Root Mean Square Error of Approximation:
##
```

```
##    RMSEA                                          0.083
##    90 Percent confidence interval - lower         0.070
##    90 Percent confidence interval - upper         0.095
##    P-value RMSEA <= 0.05                           0.000
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                            0.173
##
## Parameter Estimates:
##
##    Standard errors                             Standard
##    Information                                 Observed
##    Observed information based on                Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   indus1 =~
##     indW1S1            1.000                                   1.000     1.000
##     indW1S2    (a)     1.393    0.125   11.148    0.000     1.148     1.638
##     indW1P1  (peer)   0.695    0.121    5.766    0.000     0.459     0.931
##     indW1P2   (aa)    0.515    0.140    3.676    0.000     0.241     0.790
##   indus2 =~
##     indW2S1            1.000                                   1.000     1.000
##     indW2S2    (a)     1.393    0.125   11.148    0.000     1.148     1.638
##     indW2P1  (peer)   0.695    0.121    5.766    0.000     0.459     0.931
##     indW2P2   (aa)    0.515    0.140    3.676    0.000     0.241     0.790
##   indus3 =~
##     indW3S1            1.000                                   1.000     1.000
##     indW3S2    (a)     1.393    0.125   11.148    0.000     1.148     1.638
##     indW3P1  (peer)   0.695    0.121    5.766    0.000     0.459     0.931
##     indW3P2   (aa)    0.515    0.140    3.676    0.000     0.241     0.790
##   indus4 =~
##     indW4S1            1.000                                   1.000     1.000
##     indW4S2    (a)     1.393    0.125   11.148    0.000     1.148     1.638
##     indW4P1  (peer)   0.695    0.121    5.766    0.000     0.459     0.931
##     indW4P2   (aa)    0.515    0.140    3.676    0.000     0.241     0.790
##   interc =~
##     indus1            1.000                                   1.000     1.000
##     indus2            1.000                                   1.000     1.000
##     indus3            1.000                                   1.000     1.000
##     indus4            1.000                                   1.000     1.000
##   slope =~
##     indus1            0.000                                   0.000     0.000
##     indus2            6.000                                   6.000     6.000
##     indus3           13.000                                  13.000    13.000
##     indus4           19.000                                  19.000    19.000
##    Std.lv  Std.all
##
##    0.425    0.707
##    0.592    0.790
##    0.295    0.465
##    0.219    0.342
##
```

```
##     0.420    0.719
##     0.585    0.826
##     0.292    0.491
##     0.216    0.353
##
##     0.420    0.683
##     0.585    0.801
##     0.292    0.469
##     0.217    0.370
##
##     0.423    0.742
##     0.589    0.834
##     0.294    0.444
##     0.218    0.376
##
##     0.937    0.937
##     0.948    0.948
##     0.947    0.947
##     0.941    0.941
##
##     0.000    0.000
##     0.089    0.089
##     0.193    0.193
##     0.280    0.280
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope            0.000    0.001    0.582    0.561   -0.001    0.002
## .indusW1S1 ~~
##    .indusW2S1        0.079    0.017    4.570    0.000    0.045    0.112
##    .indusW3S1        0.075    0.018    4.176    0.000    0.040    0.111
##    .indusW4S1        0.057    0.017    3.340    0.001    0.024    0.091
## .indusW2S1 ~~
##    .indusW3S1        0.081    0.019    4.221    0.000    0.044    0.119
##    .indusW4S1        0.057    0.018    3.163    0.002    0.022    0.092
## .indusW3S1 ~~
##    .indusW4S1        0.089    0.020    4.530    0.000    0.051    0.128
## .indusW1S2 ~~
##    .indusW2S2        0.072    0.032    2.279    0.023    0.010    0.134
##    .indusW3S2        0.045    0.031    1.463    0.143   -0.015    0.105
##    .indusW4S2        0.024    0.032    0.745    0.456   -0.038    0.085
## .indusW2S2 ~~
##    .indusW3S2        0.051    0.032    1.589    0.112   -0.012    0.115
##    .indusW4S2        0.017    0.033    0.528    0.597   -0.047    0.082
## .indusW3S2 ~~
##    .indusW4S2        0.051    0.036    1.425    0.154   -0.019    0.120
## .indusW1P1 ~~
##    .indusW2P1        0.141    0.032    4.353    0.000    0.078    0.205
##    .indusW3P1        0.133    0.034    3.902    0.000    0.066    0.199
##    .indusW4P1        0.175    0.038    4.631    0.000    0.101    0.249
## .indusW2P1 ~~
##    .indusW3P1        0.178    0.037    4.767    0.000    0.105    0.252
##    .indusW4P1        0.186    0.039    4.838    0.000    0.111    0.262
```

```
## .indusW3P1 ~~
##    .indusW4P1         0.233    0.044    5.296    0.000    0.147    0.319
## .indusW1P2 ~~
##    .indusW2P2         0.167    0.037    4.516    0.000    0.094    0.239
##    .indusW3P2         0.163    0.036    4.480    0.000    0.092    0.234
##    .indusW4P2         0.162    0.042    3.851    0.000    0.079    0.244
## .indusW2P2 ~~
##    .indusW3P2         0.178    0.041    4.326    0.000    0.097    0.258
##    .indusW4P2         0.194    0.040    4.858    0.000    0.116    0.272
## .indusW3P2 ~~
##    .indusW4P2         0.189    0.039    4.815    0.000    0.112    0.266
## .indusW1S1 ~~
##    .indusW1S2         0.042    0.034    1.235    0.217   -0.025    0.109
## .indusW1P1 ~~
##    .indusW1P2         0.118    0.026    4.538    0.000    0.067    0.169
## .indusW2S1 ~~
##    .indusW2S2         0.008    0.026    0.299    0.765   -0.044    0.060
## .indusW2P1 ~~
##    .indusW2P2         0.070    0.022    3.205    0.001    0.027    0.112
## .indusW3S1 ~~
##    .indusW3S2         0.020    0.025    0.792    0.428   -0.029    0.068
## .indusW3P1 ~~
##    .indusW3P2         0.073    0.024    3.069    0.002    0.026    0.119
## .indusW4S1 ~~
##    .indusW4S2         0.026    0.026    1.022    0.307   -0.024    0.076
## .indusW4P1 ~~
##    .indusW4P2         0.031    0.023    1.356    0.175   -0.014    0.076
##    Std.lv  Std.all
##
##    0.193    0.193
##
##    0.079    0.456
##    0.075    0.396
##    0.057    0.352
##
##    0.081    0.446
##    0.057    0.367
##
##    0.089    0.519
##
##    0.072    0.392
##    0.045    0.224
##    0.024    0.131
##
##    0.051    0.294
##    0.017    0.112
##
##    0.051    0.298
##
##    0.141    0.485
##    0.133    0.430
##    0.175    0.525
##
##    0.178    0.627
```

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```
##    0.186    0.606
##
##    0.233    0.713
##
##    0.167    0.484
##    0.163    0.499
##    0.162    0.501
##
##    0.178    0.569
##    0.194    0.629
##
##    0.189    0.646
##
##    0.042    0.216
##
##    0.118    0.350
##
##    0.008    0.049
##
##    0.070    0.235
##
##    0.020    0.100
##
##    0.073    0.243
##
##    0.026    0.175
##
##    0.031    0.098
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     interc           3.325    0.035   96.267    0.000     3.257     3.393
##     slope            0.000    0.001    0.092    0.927    -0.003     0.003
##     .indusW1S1       0.000                                0.000     0.000
##     .indusW2S1       0.000                                0.000     0.000
##     .indusW3S1       0.000                                0.000     0.000
##     .indusW4S1       0.000                                0.000     0.000
##     .indusW1S2  (b) -1.615    0.418   -3.868    0.000    -2.433    -0.797
##     .indusW2S2  (b) -1.615    0.418   -3.868    0.000    -2.433    -0.797
##     .indusW3S2  (b) -1.615    0.418   -3.868    0.000    -2.433    -0.797
##     .indusW4S2  (b) -1.615    0.418   -3.868    0.000    -2.433    -0.797
##     .indusW1P1  (c)  1.432    0.402    3.566    0.000     0.645     2.220
##     .indusW2P1  (c)  1.432    0.402    3.566    0.000     0.645     2.220
##     .indusW3P1  (c)  1.432    0.402    3.566    0.000     0.645     2.220
##     .indusW4P1  (c)  1.432    0.402    3.566    0.000     0.645     2.220
##     .indusW1P2  (d)  1.888    0.466    4.052    0.000     0.974     2.801
##     .indusW2P2  (d)  1.888    0.466    4.052    0.000     0.974     2.801
##     .indusW3P2  (d)  1.888    0.466    4.052    0.000     0.974     2.801
##     .indusW4P2  (d)  1.888    0.466    4.052    0.000     0.974     2.801
##     .indus1          0.000                                0.000     0.000
##     .indus2          0.000                                0.000     0.000
##     .indus3          0.000                                0.000     0.000
##     .indus4          0.000                                0.000     0.000
##    Std.lv  Std.all
```

```
##     8.358     8.358
##     0.020     0.020
##     0.000     0.000
##     0.000     0.000
##     0.000     0.000
##     0.000     0.000
##    -1.615    -2.157
##    -1.615    -2.281
##    -1.615    -2.211
##    -1.615    -2.287
##     1.432     2.256
##     1.432     2.410
##     1.432     2.303
##     1.432     2.162
##     1.888     2.953
##     1.888     3.081
##     1.888     3.223
##     1.888     3.255
##     0.000     0.000
##     0.000     0.000
##     0.000     0.000
##     0.000     0.000
##
## Variances:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .indusW1S1      0.180    0.031    5.761    0.000    0.119    0.242
##    .indusW1S2      0.211    0.060    3.540    0.000    0.094    0.327
##    .indusW1P1      0.316    0.038    8.253    0.000    0.241    0.391
##    .indusW1P2      0.361    0.042    8.623    0.000    0.279    0.443
##    .indusW2S1      0.165    0.027    6.073    0.000    0.112    0.218
##    .indusW2S2      0.160    0.054    2.956    0.003    0.054    0.265
##    .indusW2P1      0.268    0.034    7.839    0.000    0.201    0.335
##    .indusW2P2      0.329    0.046    7.199    0.000    0.239    0.418
##    .indusW3S1      0.202    0.030    6.666    0.000    0.143    0.261
##    .indusW3S2      0.191    0.048    3.952    0.000    0.096    0.286
##    .indusW3P1      0.302    0.041    7.431    0.000    0.222    0.381
##    .indusW3P2      0.296    0.038    7.743    0.000    0.221    0.371
##    .indusW4S1      0.146    0.027    5.486    0.000    0.094    0.199
##    .indusW4S2      0.152    0.050    3.019    0.003    0.053    0.250
##    .indusW4P1      0.353    0.051    6.952    0.000    0.253    0.452
##    .indusW4P2      0.289    0.041    6.961    0.000    0.207    0.370
##    .indus1         0.022    0.023    0.944    0.345   -0.024    0.068
##    .indus2         0.011    0.018    0.603    0.546   -0.024    0.046
##    .indus3        -0.001    0.016   -0.044    0.965   -0.032    0.031
##    .indus4        -0.012    0.018   -0.647    0.518   -0.047    0.024
##     interc         0.158    0.027    5.806    0.000    0.105    0.212
##     slope          0.000    0.000    0.617    0.537   -0.000    0.000
##    Std.lv  Std.all
##     0.180    0.500
##     0.211    0.376
##     0.316    0.784
##     0.361    0.883
##     0.165    0.483
##     0.160    0.318
```

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```
##      0.268     0.759
##      0.329     0.875
##      0.202     0.533
##      0.191     0.358
##      0.302     0.780
##      0.296     0.863
##      0.146     0.450
##      0.152     0.304
##      0.353     0.803
##      0.289     0.859
##      0.122     0.122
##      0.061     0.061
##     -0.004    -0.004
##     -0.065    -0.065
##      1.000     1.000
##      1.000     1.000
```

```r
semPaths(lgmIndus, what = "col", whatLabels = "est", intercepts = T)
```
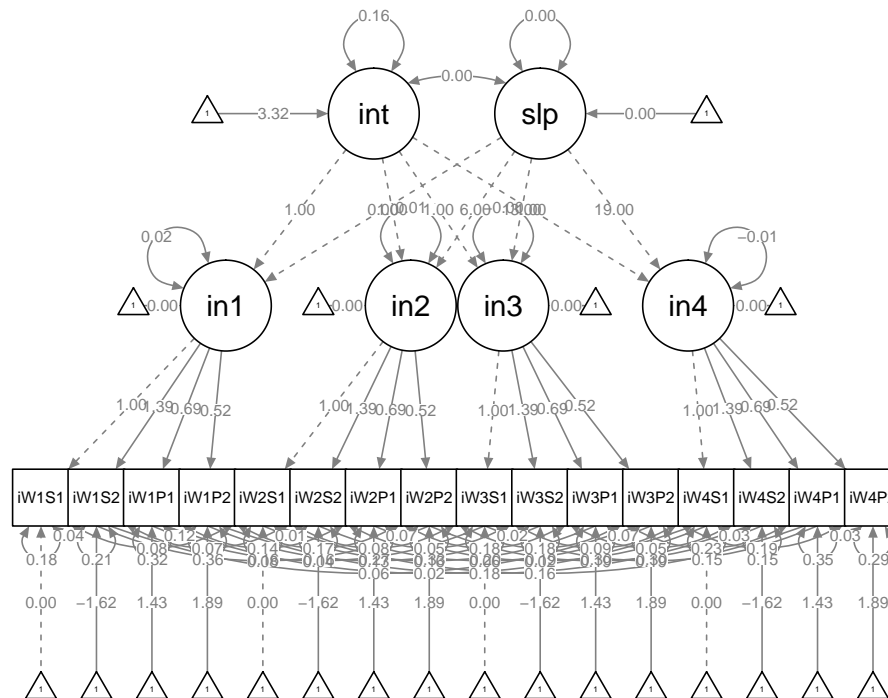

LGM Intellect

```r
lgmIntel <- '

# factor at each time point with same loading
intel1 =~ intelW1S1        + a * intelW1S2 +
          peer * intelW1P1 + aa * intelW1P2
```

```
intel2 =~ intelW2S1         + a * intelW2S2 +
           peer * intelW2P1 + aa * intelW2P2

intel3 =~ intelW3S1         + a * intelW3S2 +
           peer * intelW3P1 + aa * intelW3P2

intel4 =~ intelW4S1         + a * intelW4S2 +
           peer * intelW4P1 + aa * intelW4P2

# second order factor for intercept and slope
interc =~ 1*intel1 + 1*intel2 + 1*intel3 + 1*intel4
slope =~ 0*intel1 + 6*intel2 + 13*intel3 + 19*intel4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
intelW1S1 ~ 0*1
intelW2S1 ~ 0*1
intelW3S1 ~ 0*1
intelW4S1 ~ 0*1

# fix equal intercepts
intelW1S2 ~ b*1
intelW2S2 ~ b*1
intelW3S2 ~ b*1
intelW4S2 ~ b*1

intelW1P1 ~ c*1
intelW2P1 ~ c*1
intelW3P1 ~ c*1
intelW4P1 ~ c*1

intelW1P2 ~ d*1
intelW2P2 ~ d*1
intelW3P2 ~ d*1
intelW4P2 ~ d*1

# error covariance - similar parcels across waves
intelW1S1 ~~ intelW2S1 + intelW3S1 + intelW4S1
intelW2S1 ~~ intelW3S1 + intelW4S1
intelW3S1 ~~ intelW4S1

intelW1S2 ~~ intelW2S2 + intelW3S2 + intelW4S2
intelW2S2 ~~ intelW3S2 + intelW4S2
intelW3S2 ~~ intelW4S2

intelW1P1 ~~ intelW2P1 + intelW3P1 + intelW4P1
intelW2P1 ~~ intelW3P1 + intelW4P1
intelW3P1 ~~ intelW4P1

intelW1P2 ~~ intelW2P2 + intelW3P2 + intelW4P2
intelW2P2 ~~ intelW3P2 + intelW4P2
```

```
intelW3P2 ~~ intelW4P2

# error covariance - same method at one wave
intelW1S1 ~~ intelW1S2
intelW1P1 ~~ intelW1P2
intelW2S1 ~~ intelW2S2
intelW2P1 ~~ intelW2P2
intelW3S1 ~~ intelW3S2
intelW3P1 ~~ intelW3P2
intelW4S1 ~~ intelW4S2
intelW4P1 ~~ intelW4P2
'
lgmIntel <- sem(lgmIntel, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lgmIntel, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 186 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               238.564
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2029.552
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.922
##   Tucker-Lewis Index (TLI)                       0.894
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1330.312
##   Loglikelihood unrestricted model (H1)      -1211.030
##
##   Akaike (AIC)                                2786.624
##   Bayesian (BIC)                              3010.704
##   Sample-size adjusted Bayesian (BIC)         2810.971
```

```
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.081
##   90 Percent confidence interval - lower         0.068
##   90 Percent confidence interval - upper         0.093
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.172
##
## Parameter Estimates:
##
##   Standard errors                              Standard
##   Information                                  Observed
##   Observed information based on                 Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   intel1 =~
##     intW1S1              1.000                                1.000    1.000
##     intW1S2    (a)       1.096    0.108   10.165    0.000    0.885    1.308
##     intW1P1 (peer)       0.576    0.110    5.227    0.000    0.360    0.792
##     intW1P2   (aa)       0.416    0.108    3.856    0.000    0.205    0.628
##   intel2 =~
##     intW2S1              1.000                                1.000    1.000
##     intW2S2    (a)       1.096    0.108   10.165    0.000    0.885    1.308
##     intW2P1 (peer)       0.576    0.110    5.227    0.000    0.360    0.792
##     intW2P2   (aa)       0.416    0.108    3.856    0.000    0.205    0.628
##   intel3 =~
##     intW3S1              1.000                                1.000    1.000
##     intW3S2    (a)       1.096    0.108   10.165    0.000    0.885    1.308
##     intW3P1 (peer)       0.576    0.110    5.227    0.000    0.360    0.792
##     intW3P2   (aa)       0.416    0.108    3.856    0.000    0.205    0.628
##   intel4 =~
##     intW4S1              1.000                                1.000    1.000
##     intW4S2    (a)       1.096    0.108   10.165    0.000    0.885    1.308
##     intW4P1 (peer)       0.576    0.110    5.227    0.000    0.360    0.792
##     intW4P2   (aa)       0.416    0.108    3.856    0.000    0.205    0.628
##   interc =~
##     intel1               1.000                                1.000    1.000
##     intel2               1.000                                1.000    1.000
##     intel3               1.000                                1.000    1.000
##     intel4               1.000                                1.000    1.000
##   slope =~
##     intel1               0.000                                0.000    0.000
##     intel2               6.000                                6.000    6.000
##     intel3              13.000                               13.000   13.000
##     intel4              19.000                               19.000   19.000
##    Std.lv  Std.all
##
##    0.437    0.757
##    0.479    0.747
```

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```
##     0.252    0.457
##     0.182    0.332
##
##     0.407    0.721
##     0.446    0.708
##     0.234    0.425
##     0.169    0.356
##
##     0.406    0.700
##     0.446    0.718
##     0.234    0.393
##     0.169    0.292
##
##     0.365    0.646
##     0.400    0.680
##     0.210    0.328
##     0.152    0.297
##
##     0.967    0.967
##     1.039    1.039
##     1.040    1.040
##     1.158    1.158
##
##     0.000    0.000
##     0.014    0.014
##     0.030    0.030
##     0.049    0.049
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##   interc ~~
##     slope          -0.000    0.001   -0.050    0.960   -0.002    0.002
##  .intelW1S1 ~~
##    .intelW2S1        0.061    0.019    3.251    0.001    0.024    0.097
##    .intelW3S1        0.060    0.019    3.088    0.002    0.022    0.098
##    .intelW4S1        0.041    0.018    2.244    0.025    0.005    0.078
##  .intelW2S1 ~~
##    .intelW3S1        0.072    0.020    3.514    0.000    0.032    0.111
##    .intelW4S1        0.043    0.019    2.244    0.025    0.005    0.081
##  .intelW3S1 ~~
##    .intelW4S1        0.053    0.021    2.585    0.010    0.013    0.093
##  .intelW1S2 ~~
##    .intelW2S2        0.069    0.023    3.050    0.002    0.025    0.113
##    .intelW3S2        0.049    0.023    2.176    0.030    0.005    0.093
##    .intelW4S2        0.051    0.022    2.322    0.020    0.008    0.094
##  .intelW2S2 ~~
##    .intelW3S2        0.087    0.025    3.482    0.000    0.038    0.136
##    .intelW4S2        0.075    0.024    3.143    0.002    0.028    0.122
##  .intelW3S2 ~~
##    .intelW4S2        0.062    0.024    2.599    0.009    0.015    0.109
##  .intelW1P1 ~~
##    .intelW2P1        0.132    0.029    4.522    0.000    0.075    0.190
##    .intelW3P1        0.187    0.032    5.807    0.000    0.124    0.251
##    .intelW4P1        0.150    0.031    4.784    0.000    0.088    0.211
```

```
##   .intelW2P1 ~~
##     .intelW3P1          0.189    0.035    5.398    0.000    0.121    0.258
##     .intelW4P1          0.153    0.036    4.275    0.000    0.083    0.224
##   .intelW3P1 ~~
##     .intelW4P1          0.172    0.041    4.192    0.000    0.092    0.253
##   .intelW1P2 ~~
##     .intelW2P2          0.166    0.025    6.529    0.000    0.116    0.215
##     .intelW3P2          0.181    0.033    5.445    0.000    0.116    0.247
##     .intelW4P2          0.135    0.028    4.798    0.000    0.080    0.190
##   .intelW2P2 ~~
##     .intelW3P2          0.158    0.030    5.325    0.000    0.100    0.216
##     .intelW4P2          0.126    0.024    5.266    0.000    0.079    0.172
##   .intelW3P2 ~~
##     .intelW4P2          0.155    0.034    4.620    0.000    0.089    0.221
##   .intelW1S1 ~~
##     .intelW1S2          0.035    0.023    1.497    0.135   -0.011    0.081
##   .intelW1P1 ~~
##     .intelW1P2          0.058    0.014    4.250    0.000    0.031    0.084
##   .intelW2S1 ~~
##     .intelW2S2          0.043    0.019    2.345    0.019    0.007    0.080
##   .intelW2P1 ~~
##     .intelW2P2          0.030    0.013    2.206    0.027    0.003    0.056
##   .intelW3S1 ~~
##     .intelW3S2          0.028    0.021    1.311    0.190   -0.014    0.069
##   .intelW3P1 ~~
##     .intelW3P2          0.029    0.019    1.522    0.128   -0.008    0.066
##   .intelW4S1 ~~
##     .intelW4S2          0.070    0.033    2.145    0.032    0.006    0.134
##   .intelW4P1 ~~
##     .intelW4P2          0.123    0.029    4.232    0.000    0.066    0.180
##    Std.lv  Std.all
##
##    -0.103   -0.103
##
##     0.061    0.411
##     0.060    0.382
##     0.041    0.255
##
##     0.072    0.442
##     0.043    0.257
##
##     0.053    0.297
##
##     0.069    0.362
##     0.049    0.267
##     0.051    0.278
##
##     0.087    0.453
##     0.075    0.391
##
##     0.062    0.335
##
##     0.132    0.541
##     0.187    0.699
```

```
##      0.150    0.505
##
##      0.189    0.692
##      0.153    0.507
##
##      0.172    0.520
##
##      0.166    0.720
##      0.181    0.634
##      0.135    0.535
##
##      0.158    0.639
##      0.126    0.579
##
##      0.155    0.576
##
##      0.035    0.217
##
##      0.058    0.228
##
##      0.043    0.250
##
##      0.030    0.133
##
##      0.028    0.154
##
##      0.029    0.096
##
##      0.070    0.377
##
##      0.123    0.417
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##      interc           3.686    0.034  107.977    0.000     3.619    3.753
##      slope           -0.001    0.001   -0.475    0.635    -0.003    0.002
##     .intelW1S1        0.000                                0.000    0.000
##     .intelW2S1        0.000                                0.000    0.000
##     .intelW3S1        0.000                                0.000    0.000
##     .intelW4S1        0.000                                0.000    0.000
##     .intelW1S2  (b)  -0.414    0.398   -1.042    0.298    -1.194    0.365
##     .intelW2S2  (b)  -0.414    0.398   -1.042    0.298    -1.194    0.365
##     .intelW3S2  (b)  -0.414    0.398   -1.042    0.298    -1.194    0.365
##     .intelW4S2  (b)  -0.414    0.398   -1.042    0.298    -1.194    0.365
##     .intelW1P1  (c)   1.841    0.404    4.552    0.000     1.048    2.634
##     .intelW2P1  (c)   1.841    0.404    4.552    0.000     1.048    2.634
##     .intelW3P1  (c)   1.841    0.404    4.552    0.000     1.048    2.634
##     .intelW4P1  (c)   1.841    0.404    4.552    0.000     1.048    2.634
##     .intelW1P2  (d)   2.461    0.398    6.185    0.000     1.681    3.241
##     .intelW2P2  (d)   2.461    0.398    6.185    0.000     1.681    3.241
##     .intelW3P2  (d)   2.461    0.398    6.185    0.000     1.681    3.241
##     .intelW4P2  (d)   2.461    0.398    6.185    0.000     1.681    3.241
##     .intel1           0.000                                0.000    0.000
##     .intel2           0.000                                0.000    0.000
```

```
##    .intel3              0.000                                      0.000    0.000
##    .intel4              0.000                                      0.000    0.000
##    Std.lv  Std.all
##    8.723   8.723
##   -0.650  -0.650
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##   -0.414  -0.647
##   -0.414  -0.658
##   -0.414  -0.668
##   -0.414  -0.705
##    1.841   3.346
##    1.841   3.336
##    1.841   3.092
##    1.841   2.873
##    2.461   4.491
##    2.461   5.168
##    2.461   4.252
##    2.461   4.820
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .intelW1S1          0.142    0.030    4.739    0.000    0.083    0.201
##    .intelW1S2          0.181    0.034    5.281    0.000    0.114    0.249
##    .intelW1P1          0.239    0.030    7.890    0.000    0.180    0.299
##    .intelW1P2          0.267    0.032    8.383    0.000    0.205    0.330
##    .intelW2S1          0.153    0.025    6.206    0.000    0.105    0.201
##    .intelW2S2          0.198    0.034    5.781    0.000    0.131    0.265
##    .intelW2P1          0.250    0.033    7.452    0.000    0.184    0.315
##    .intelW2P2          0.198    0.025    7.998    0.000    0.150    0.247
##    .intelW3S1          0.172    0.031    5.587    0.000    0.111    0.232
##    .intelW3S2          0.186    0.032    5.804    0.000    0.123    0.249
##    .intelW3P1          0.300    0.040    7.412    0.000    0.220    0.379
##    .intelW3P2          0.306    0.041    7.444    0.000    0.226    0.387
##    .intelW4S1          0.186    0.037    5.033    0.000    0.114    0.259
##    .intelW4S2          0.186    0.039    4.770    0.000    0.109    0.262
##    .intelW4P1          0.367    0.048    7.683    0.000    0.273    0.460
##    .intelW4P2          0.238    0.030    8.005    0.000    0.179    0.296
##    .intel1             0.012    0.019    0.634    0.526   -0.026    0.050
##    .intel2            -0.013    0.015   -0.862    0.388   -0.041    0.016
##    .intel3            -0.012    0.017   -0.754    0.451   -0.045    0.020
##    .intel4            -0.044    0.027   -1.646    0.100   -0.097    0.008
##     interc             0.179    0.031    5.770    0.000    0.118    0.239
##     slope              0.000    0.000    0.017    0.987   -0.000    0.000
##    Std.lv  Std.all
##    0.142   0.427
##    0.181   0.442
##    0.239   0.791
```

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```
##     0.267    0.890
##     0.153    0.480
##     0.198    0.499
##     0.250    0.820
##     0.198    0.874
##     0.172    0.510
##     0.186    0.484
##     0.300    0.845
##     0.306    0.915
##     0.186    0.583
##     0.186    0.537
##     0.367    0.892
##     0.238    0.912
##     0.065    0.065
##    -0.076   -0.076
##    -0.075   -0.075
##    -0.332   -0.332
##     1.000    1.000
##     1.000    1.000
```

```
semPaths(lgmIntel, what = "col", whatLabels = "est", intercepts = T)
```
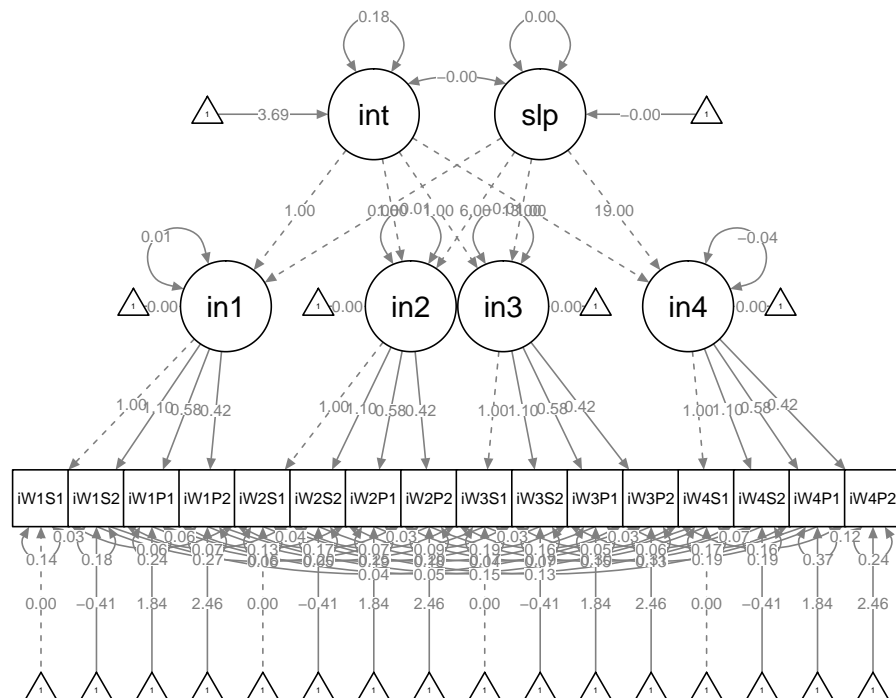

LGM Openness aspect

```
lgmOpena <- '
```

```
# factor at each time point with same loading
opena1 =~ openaW1S1        + a * openaW1S2 +
          peer * openaW1P1 + aa * openaW1P2

opena2 =~ openaW2S1        + a * openaW2S2 +
          peer * openaW2P1 + aa * openaW2P2

opena3 =~ openaW3S1        + a * openaW3S2 +
          peer * openaW3P1 + aa * openaW3P2

opena4 =~ openaW4S1        + a * openaW4S2 +
          peer * openaW4P1 + aa * openaW4P2

# second order factor for intercept and slope
interc =~ 1*opena1 + 1*opena2 + 1*opena3 + 1*opena4
slope =~ 0*opena1 + 6*opena2 + 13*opena3 + 19*opena4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
openaW1S1 ~ 0*1
openaW2S1 ~ 0*1
openaW3S1 ~ 0*1
openaW4S1 ~ 0*1

# fix equal intercepts
openaW1S2 ~ b*1
openaW2S2 ~ b*1
openaW3S2 ~ b*1
openaW4S2 ~ b*1

openaW1P1 ~ c*1
openaW2P1 ~ c*1
openaW3P1 ~ c*1
openaW4P1 ~ c*1

openaW1P2 ~ d*1
openaW2P2 ~ d*1
openaW3P2 ~ d*1
openaW4P2 ~ d*1

# error covariance - similar parcels across waves
openaW1S1 ~~ openaW2S1 + openaW3S1 + openaW4S1
openaW2S1 ~~ openaW3S1 + openaW4S1
openaW3S1 ~~ openaW4S1

openaW1S2 ~~ openaW2S2 + openaW3S2 + openaW4S2
openaW2S2 ~~ openaW3S2 + openaW4S2
openaW3S2 ~~ openaW4S2

openaW1P1 ~~ openaW2P1 + openaW3P1 + openaW4P1
openaW2P1 ~~ openaW3P1 + openaW4P1
```

```
openaW3P1 ~~ openaW4P1

openaW1P2 ~~ openaW2P2 + openaW3P2 + openaW4P2
openaW2P2 ~~ openaW3P2 + openaW4P2
openaW3P2 ~~ openaW4P2

# error covariance – same method at one wave
openaW1S1 ~~ openaW1S2
openaW1P1 ~~ openaW1P2
openaW2S1 ~~ openaW2S2
openaW2P1 ~~ openaW2P2
openaW3S1 ~~ openaW3S2
openaW3P1 ~~ openaW3P2
openaW4S1 ~~ openaW4S2
openaW4P1 ~~ openaW4P2
'
lgmOpena <- sem(lgmOpena, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lgmOpena, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 172 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               170.483
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2368.492
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.964
##   Tucker-Lewis Index (TLI)                       0.951
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1152.281
##   Loglikelihood unrestricted model (H1)      -1067.039
```

```
##
##   Akaike (AIC)                             2430.561
##   Bayesian (BIC)                           2654.642
##   Sample-size adjusted Bayesian (BIC)      2454.909
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                       0.059
##   90 Percent confidence interval - lower      0.046
##   90 Percent confidence interval - upper      0.073
##   P-value RMSEA <= 0.05                       0.122
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                        0.118
##
## Parameter Estimates:
##
##   Standard errors                          Standard
##   Information                              Observed
##   Observed information based on             Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   opena1 =~
##     opnW1S1           1.000                                1.000     1.000
##     opnW1S2    (a)    0.913    0.064   14.259    0.000     0.787     1.038
##     opnW1P1 (peer)    0.632    0.079    8.028    0.000     0.478     0.786
##     opnW1P2   (aa)    0.505    0.078    6.505    0.000     0.353     0.658
##   opena2 =~
##     opnW2S1           1.000                                1.000     1.000
##     opnW2S2    (a)    0.913    0.064   14.259    0.000     0.787     1.038
##     opnW2P1 (peer)    0.632    0.079    8.028    0.000     0.478     0.786
##     opnW2P2   (aa)    0.505    0.078    6.505    0.000     0.353     0.658
##   opena3 =~
##     opnW3S1           1.000                                1.000     1.000
##     opnW3S2    (a)    0.913    0.064   14.259    0.000     0.787     1.038
##     opnW3P1 (peer)    0.632    0.079    8.028    0.000     0.478     0.786
##     opnW3P2   (aa)    0.505    0.078    6.505    0.000     0.353     0.658
##   opena4 =~
##     opnW4S1           1.000                                1.000     1.000
##     opnW4S2    (a)    0.913    0.064   14.259    0.000     0.787     1.038
##     opnW4P1 (peer)    0.632    0.079    8.028    0.000     0.478     0.786
##     opnW4P2   (aa)    0.505    0.078    6.505    0.000     0.353     0.658
##   interc =~
##     opena1            1.000                                1.000     1.000
##     opena2            1.000                                1.000     1.000
##     opena3            1.000                                1.000     1.000
##     opena4            1.000                                1.000     1.000
##   slope =~
##     opena1            0.000                                0.000     0.000
##     opena2            6.000                                6.000     6.000
##     opena3           13.000                               13.000    13.000
##     opena4           19.000                               19.000    19.000
```

```
##     Std.lv  Std.all
##
##    0.501    0.751
##    0.457    0.780
##    0.316    0.573
##    0.253    0.514
##
##    0.506    0.770
##    0.462    0.781
##    0.320    0.577
##    0.256    0.462
##
##    0.499    0.782
##    0.455    0.818
##    0.315    0.590
##    0.252    0.487
##
##    0.502    0.732
##    0.458    0.759
##    0.317    0.567
##    0.254    0.506
##
##    1.004    1.004
##    0.993    0.993
##    1.007    1.007
##    1.001    1.001
##
##    0.000    0.000
##    0.079    0.079
##    0.173    0.173
##    0.252    0.252
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope             0.000    0.001    0.363    0.717   -0.001    0.002
## .openaW1S1 ~~
##    .openaW2S1         0.108    0.019    5.606    0.000    0.070    0.146
##    .openaW3S1         0.086    0.018    4.880    0.000    0.051    0.121
##    .openaW4S1         0.102    0.020    5.082    0.000    0.062    0.141
## .openaW2S1 ~~
##    .openaW3S1         0.086    0.018    4.711    0.000    0.050    0.122
##    .openaW4S1         0.096    0.020    4.684    0.000    0.056    0.136
## .openaW3S1 ~~
##    .openaW4S1         0.085    0.020    4.328    0.000    0.046    0.123
## .openaW1S2 ~~
##    .openaW2S2         0.035    0.015    2.297    0.022    0.005    0.065
##    .openaW3S2         0.038    0.014    2.681    0.007    0.010    0.065
##    .openaW4S2         0.040    0.016    2.442    0.015    0.008    0.071
## .openaW2S2 ~~
##    .openaW3S2         0.052    0.015    3.507    0.000    0.023    0.082
##    .openaW4S2         0.051    0.017    2.983    0.003    0.017    0.085
## .openaW3S2 ~~
##    .openaW4S2         0.051    0.016    3.204    0.001    0.020    0.083
```

```
## .openaW1P1 ~~
##     .openaW2P1          0.092    0.022    4.274    0.000    0.050    0.135
##     .openaW3P1          0.094    0.022    4.263    0.000    0.051    0.137
##     .openaW4P1          0.022    0.027    0.813    0.416   -0.031    0.075
## .openaW2P1 ~~
##     .openaW3P1          0.128    0.025    5.102    0.000    0.079    0.177
##     .openaW4P1          0.075    0.029    2.579    0.010    0.018    0.132
## .openaW3P1 ~~
##     .openaW4P1          0.101    0.030    3.335    0.001    0.042    0.161
## .openaW1P2 ~~
##     .openaW2P2          0.122    0.022    5.598    0.000    0.079    0.165
##     .openaW3P2          0.089    0.022    4.030    0.000    0.046    0.133
##     .openaW4P2          0.106    0.021    5.018    0.000    0.065    0.148
## .openaW2P2 ~~
##     .openaW3P2          0.138    0.027    5.140    0.000    0.085    0.190
##     .openaW4P2          0.126    0.027    4.719    0.000    0.074    0.179
## .openaW3P2 ~~
##     .openaW4P2          0.130    0.029    4.415    0.000    0.072    0.187
## .openaW1S1 ~~
##     .openaW1S2          0.040    0.017    2.430    0.015    0.008    0.073
## .openaW1P1 ~~
##     .openaW1P2          0.050    0.013    3.714    0.000    0.024    0.076
## .openaW2S1 ~~
##     .openaW2S2          0.036    0.016    2.213    0.027    0.004    0.068
## .openaW2P1 ~~
##     .openaW2P2          0.033    0.014    2.301    0.021    0.005    0.061
## .openaW3S1 ~~
##     .openaW3S2          0.031    0.013    2.384    0.017    0.005    0.056
## .openaW3P1 ~~
##     .openaW3P2          0.027    0.012    2.156    0.031    0.002    0.051
## .openaW4S1 ~~
##     .openaW4S2          0.062    0.023    2.693    0.007    0.017    0.107
## .openaW4P1 ~~
##     .openaW4P2          0.047    0.022    2.111    0.035    0.003    0.091
##    Std.lv  Std.all
##
##    0.097    0.097
##
##    0.108    0.586
##    0.086    0.491
##    0.102    0.494
##
##    0.086    0.518
##    0.096    0.489
##
##    0.085    0.455
##
##    0.035    0.258
##    0.038    0.320
##    0.040    0.274
##
##    0.052    0.442
##    0.051    0.352
##
```

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```
##    0.051    0.409
##
##    0.092    0.451
##    0.094    0.479
##    0.022    0.105
##
##    0.128    0.656
##    0.075    0.358
##
##    0.101    0.508
##
##    0.122    0.588
##    0.089    0.469
##    0.106    0.582
##
##    0.138    0.620
##    0.126    0.594
##
##    0.130    0.663
##
##    0.040    0.250
##
##    0.050    0.260
##
##    0.036    0.234
##
##    0.033    0.148
##
##    0.031    0.241
##
##    0.027    0.137
##
##    0.062    0.338
##
##    0.047    0.237
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     interc           3.840    0.040   96.496    0.000    3.762    3.918
##     slope            0.000    0.001    0.165    0.869   -0.002    0.003
##    .openaW1S1        0.000                               0.000    0.000
##    .openaW2S1        0.000                               0.000    0.000
##    .openaW3S1        0.000                               0.000    0.000
##    .openaW4S1        0.000                               0.000    0.000
##    .openaW1S2  (b)   0.401    0.247    1.619    0.105   -0.084    0.886
##    .openaW2S2  (b)   0.401    0.247    1.619    0.105   -0.084    0.886
##    .openaW3S2  (b)   0.401    0.247    1.619    0.105   -0.084    0.886
##    .openaW4S2  (b)   0.401    0.247    1.619    0.105   -0.084    0.886
##    .openaW1P1  (c)   1.386    0.305    4.545    0.000    0.788    1.983
##    .openaW2P1  (c)   1.386    0.305    4.545    0.000    0.788    1.983
##    .openaW3P1  (c)   1.386    0.305    4.545    0.000    0.788    1.983
##    .openaW4P1  (c)   1.386    0.305    4.545    0.000    0.788    1.983
##    .openaW1P2  (d)   1.707    0.300    5.686    0.000    1.119    2.296
##    .openaW2P2  (d)   1.707    0.300    5.686    0.000    1.119    2.296
```

```
##     .openaW3P2  (d)     1.707   0.300   5.686   0.000   1.119   2.296
##     .openaW4P2  (d)     1.707   0.300   5.686   0.000   1.119   2.296
##     .opena1             0.000                           0.000   0.000
##     .opena2             0.000                           0.000   0.000
##     .opena3             0.000                           0.000   0.000
##     .opena4             0.000                           0.000   0.000
##    Std.lv  Std.all
##    7.643   7.643
##    0.033   0.033
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##    0.401   0.684
##    0.401   0.678
##    0.401   0.720
##    0.401   0.664
##    1.386   2.509
##    1.386   2.501
##    1.386   2.593
##    1.386   2.476
##    1.707   3.467
##    1.707   3.082
##    1.707   3.300
##    1.707   3.405
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     .openaW1S1        0.194    0.027    7.288    0.000     0.142     0.246
##     .openaW1S2        0.135    0.023    5.893    0.000     0.090     0.179
##     .openaW1P1        0.205    0.026    7.919    0.000     0.154     0.256
##     .openaW1P2        0.178    0.021    8.310    0.000     0.136     0.221
##     .openaW2S1        0.175    0.027    6.407    0.000     0.122     0.229
##     .openaW2S2        0.136    0.024    5.787    0.000     0.090     0.182
##     .openaW2P1        0.205    0.028    7.249    0.000     0.149     0.260
##     .openaW2P2        0.241    0.030    8.065    0.000     0.183     0.300
##     .openaW3S1        0.158    0.023    6.832    0.000     0.113     0.203
##     .openaW3S2        0.103    0.018    5.569    0.000     0.067     0.139
##     .openaW3P1        0.186    0.027    7.002    0.000     0.134     0.238
##     .openaW3P2        0.204    0.030    6.795    0.000     0.145     0.263
##     .openaW4S1        0.218    0.035    6.166    0.000     0.149     0.287
##     .openaW4S2        0.154    0.028    5.556    0.000     0.100     0.209
##     .openaW4P1        0.213    0.033    6.491    0.000     0.148     0.277
##     .openaW4P2        0.187    0.027    6.885    0.000     0.134     0.240
##     .opena1          -0.002    0.017   -0.103    0.918    -0.035     0.032
##     .opena2          -0.002    0.015   -0.125    0.901    -0.032     0.028
##     .opena3          -0.019    0.012   -1.649    0.099    -0.043     0.004
##     .opena4          -0.029    0.022   -1.321    0.187    -0.072     0.014
##      interc           0.252    0.037    6.759    0.000     0.179     0.326
##      slope            0.000    0.000    0.880    0.379    -0.000     0.000
```

```
##      Std.lv  Std.all
##       0.194    0.436
##       0.135    0.392
##       0.205    0.672
##       0.178    0.736
##       0.175    0.407
##       0.136    0.390
##       0.205    0.667
##       0.241    0.787
##       0.158    0.388
##       0.103    0.331
##       0.186    0.652
##       0.204    0.763
##       0.218    0.464
##       0.154    0.424
##       0.213    0.679
##       0.187    0.744
##      -0.007   -0.007
##      -0.008   -0.008
##      -0.078   -0.078
##      -0.115   -0.115
##       1.000    1.000
##       1.000    1.000
```

```r
semPaths(lgmOpena, what = "col", whatLabels = "est", intercepts = T)
```
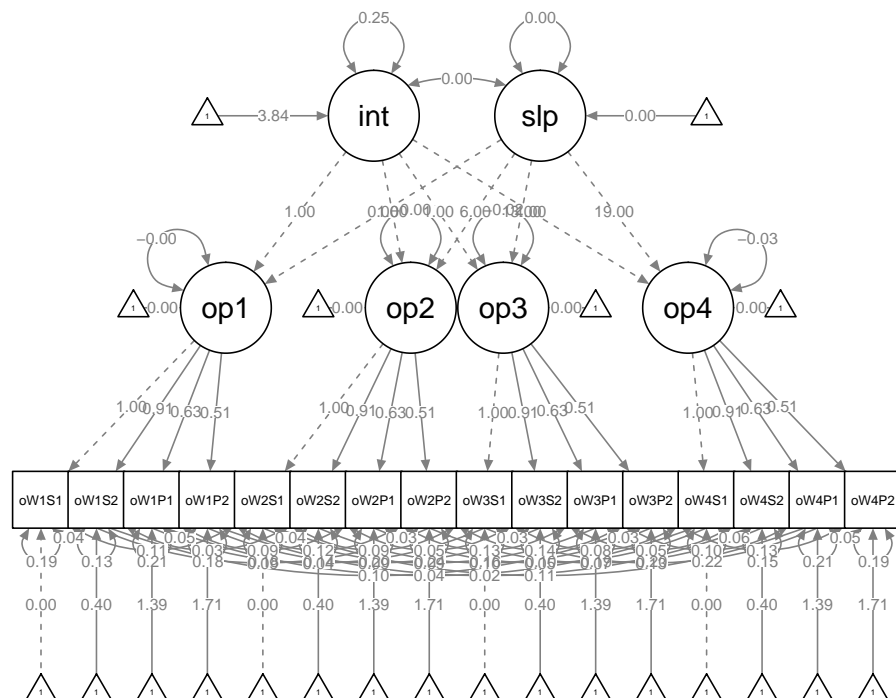
LGM Orderliness

```
lgmOrder <- '

# factor at each time point with same loading
order1 =~ orderW1S1        + a * orderW1S2 +
          peer * orderW1P1 + aa * orderW1P2


order2 =~ orderW2S1        + a * orderW2S2 +
          peer * orderW2P1 + aa * orderW2P2


order3 =~ orderW3S1        + a * orderW3S2 +
          peer * orderW3P1 + aa * orderW3P2


order4 =~ orderW4S1        + a * orderW4S2 +
          peer * orderW4P1 + aa * orderW4P2

# second order factor for intercept and slope
interc =~ 1*order1 + 1*order2 + 1*order3 + 1*order4
slope =~ 0*order1 + 6*order2 + 13*order3 + 19*order4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
orderW1S1 ~ 0*1
orderW2S1 ~ 0*1
orderW3S1 ~ 0*1
orderW4S1 ~ 0*1

# fix equal intercepts
orderW1S2 ~ b*1
orderW2S2 ~ b*1
orderW3S2 ~ b*1
orderW4S2 ~ b*1


orderW1P1 ~ c*1
orderW2P1 ~ c*1
orderW3P1 ~ c*1
orderW4P1 ~ c*1


orderW1P2 ~ d*1
orderW2P2 ~ d*1
orderW3P2 ~ d*1
orderW4P2 ~ d*1

# error covariance - similar parcels across waves
orderW1S1 ~~ orderW2S1 + orderW3S1 + orderW4S1
orderW2S1 ~~ orderW3S1 + orderW4S1
orderW3S1 ~~ orderW4S1

orderW1S2 ~~ orderW2S2 + orderW3S2 + orderW4S2
orderW2S2 ~~ orderW3S2 + orderW4S2
orderW3S2 ~~ orderW4S2
```

```r
orderW1P1 ~~ orderW2P1 + orderW3P1 + orderW4P1
orderW2P1 ~~ orderW3P1 + orderW4P1
orderW3P1 ~~ orderW4P1

orderW1P2 ~~ orderW2P2 + orderW3P2 + orderW4P2
orderW2P2 ~~ orderW3P2 + orderW4P2
orderW3P2 ~~ orderW4P2

# error covariance - same method at one wave
orderW1S1 ~~ orderW1S2
orderW1P1 ~~ orderW1P2
orderW2S1 ~~ orderW2S2
orderW2P1 ~~ orderW2P2
orderW3S1 ~~ orderW3S2
orderW3P1 ~~ orderW3P2
orderW4S1 ~~ orderW4S2
orderW4P1 ~~ orderW4P2
'
lgmOrder <- sem(lgmOrder, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```r
summary(lgmOrder, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 149 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               177.467
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2131.446
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.956
##   Tucker-Lewis Index (TLI)                       0.941
##
## Loglikelihood and Information Criteria:
##
```

```
##    Loglikelihood user model (H0)              -1607.660
##    Loglikelihood unrestricted model (H1)      -1518.927
##
##    Akaike (AIC)                                3341.321
##    Bayesian (BIC)                              3565.401
##    Sample-size adjusted Bayesian (BIC)         3365.668
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                        0.062
##    90 Percent confidence interval - lower       0.049
##    90 Percent confidence interval - upper       0.075
##    P-value RMSEA <= 0.05                         0.070
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                         0.110
##
## Parameter Estimates:
##
##    Standard errors                            Standard
##    Information                                Observed
##    Observed information based on               Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    order1 =~
##      ordW1S1             1.000                                  1.000    1.000
##      ordW1S2     (a)     0.782    0.053   14.783    0.000       0.678    0.885
##      ordW1P1 (peer)      0.788    0.096    8.206    0.000       0.600    0.976
##      ordW1P2    (aa)     0.565    0.076    7.407    0.000       0.415    0.714
##    order2 =~
##      ordW2S1             1.000                                  1.000    1.000
##      ordW2S2     (a)     0.782    0.053   14.783    0.000       0.678    0.885
##      ordW2P1 (peer)      0.788    0.096    8.206    0.000       0.600    0.976
##      ordW2P2    (aa)     0.565    0.076    7.407    0.000       0.415    0.714
##    order3 =~
##      ordW3S1             1.000                                  1.000    1.000
##      ordW3S2     (a)     0.782    0.053   14.783    0.000       0.678    0.885
##      ordW3P1 (peer)      0.788    0.096    8.206    0.000       0.600    0.976
##      ordW3P2    (aa)     0.565    0.076    7.407    0.000       0.415    0.714
##    order4 =~
##      ordW4S1             1.000                                  1.000    1.000
##      ordW4S2     (a)     0.782    0.053   14.783    0.000       0.678    0.885
##      ordW4P1 (peer)      0.788    0.096    8.206    0.000       0.600    0.976
##      ordW4P2    (aa)     0.565    0.076    7.407    0.000       0.415    0.714
##    interc =~
##      order1             1.000                                  1.000    1.000
##      order2             1.000                                  1.000    1.000
##      order3             1.000                                  1.000    1.000
##      order4             1.000                                  1.000    1.000
##    slope =~
##      order1             0.000                                  0.000    0.000
##      order2             6.000                                  6.000    6.000
```

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```
##    order3              13.000                              13.000    13.000
##    order4              19.000                              19.000    19.000
##    Std.lv  Std.all
##
##    0.534    0.761
##    0.417    0.656
##    0.421    0.577
##    0.301    0.494
##
##    0.538    0.799
##    0.421    0.691
##    0.424    0.624
##    0.304    0.558
##
##    0.524    0.777
##    0.410    0.693
##    0.413    0.545
##    0.296    0.527
##
##    0.587    0.822
##    0.459    0.732
##    0.463    0.606
##    0.332    0.565
##
##    1.013    1.013
##    1.005    1.005
##    1.031    1.031
##    0.920    0.920
##
##    0.000    0.000
##    0.101    0.101
##    0.225    0.225
##    0.294    0.294
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    interc ~~
##      slope          0.000    0.001    0.336    0.737   -0.002    0.003
##  .orderW1S1 ~~
##    .orderW2S1        0.001    0.022    0.049    0.961   -0.041    0.043
##    .orderW3S1        0.029    0.021    1.353    0.176   -0.013    0.071
##    .orderW4S1        0.006    0.023    0.260    0.795   -0.039    0.051
##  .orderW2S1 ~~
##    .orderW3S1        0.032    0.023    1.379    0.168   -0.013    0.076
##    .orderW4S1       -0.003    0.023   -0.122    0.903   -0.047    0.042
##  .orderW3S1 ~~
##    .orderW4S1        0.037    0.024    1.540    0.124   -0.010    0.085
##  .orderW1S2 ~~
##    .orderW2S2        0.089    0.016    5.399    0.000    0.056    0.121
##    .orderW3S2        0.060    0.015    3.892    0.000    0.030    0.090
##    .orderW4S2        0.061    0.017    3.617    0.000    0.028    0.094
##  .orderW2S2 ~~
##    .orderW3S2        0.073    0.016    4.432    0.000    0.041    0.105
##    .orderW4S2        0.075    0.018    4.275    0.000    0.041    0.110
```

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```
##   .orderW3S2 ~~
##     .orderW4S2          0.081    0.016    4.917    0.000    0.049    0.113
##   .orderW1P1 ~~
##     .orderW2P1          0.150    0.037    4.091    0.000    0.078    0.221
##     .orderW3P1          0.176    0.045    3.924    0.000    0.088    0.263
##     .orderW4P1          0.182    0.042    4.353    0.000    0.100    0.264
##   .orderW2P1 ~~
##     .orderW3P1          0.205    0.041    5.024    0.000    0.125    0.285
##     .orderW4P1          0.203    0.038    5.325    0.000    0.128    0.277
##   .orderW3P1 ~~
##     .orderW4P1          0.262    0.047    5.576    0.000    0.170    0.355
##   .orderW1P2 ~~
##     .orderW2P2          0.124    0.027    4.628    0.000    0.072    0.177
##     .orderW3P2          0.123    0.029    4.239    0.000    0.066    0.179
##     .orderW4P2          0.087    0.028    3.129    0.002    0.033    0.142
##   .orderW2P2 ~~
##     .orderW3P2          0.124    0.026    4.802    0.000    0.073    0.174
##     .orderW4P2          0.102    0.025    4.015    0.000    0.052    0.152
##   .orderW3P2 ~~
##     .orderW4P2          0.080    0.030    2.707    0.007    0.022    0.138
##   .orderW1S1 ~~
##     .orderW1S2          0.088    0.023    3.767    0.000    0.042    0.134
##   .orderW1P1 ~~
##     .orderW1P2          0.088    0.026    3.428    0.001    0.038    0.138
##   .orderW2S1 ~~
##     .orderW2S2          0.010    0.016    0.604    0.546   -0.022    0.042
##   .orderW2P1 ~~
##     .orderW2P2          0.036    0.016    2.340    0.019    0.006    0.067
##   .orderW3S1 ~~
##     .orderW3S2          0.043    0.017    2.554    0.011    0.010    0.077
##   .orderW3P1 ~~
##     .orderW3P2          0.071    0.023    3.130    0.002    0.026    0.115
##   .orderW4S1 ~~
##     .orderW4S2          0.056    0.030    1.861    0.063   -0.003    0.114
##   .orderW4P1 ~~
##     .orderW4P2          0.103    0.029    3.536    0.000    0.046    0.161
##    Std.lv  Std.all
##
##    0.089    0.089
##
##    0.001    0.006
##    0.029    0.149
##    0.006    0.032
##
##    0.032    0.183
##   -0.003   -0.017
##
##    0.037    0.216
##
##    0.089    0.420
##    0.060    0.291
##    0.061    0.296
##
##    0.073    0.388
```

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```
##     0.075    0.402
##
##     0.081    0.444
##
##     0.150    0.473
##     0.176    0.464
##     0.182    0.504
##
##     0.205    0.607
##     0.203    0.628
##
##     0.262    0.680
##
##     0.124    0.520
##     0.123    0.485
##     0.087    0.340
##
##     0.124    0.575
##     0.102    0.467
##
##     0.080    0.347
##
##     0.088    0.404
##
##     0.088    0.278
##
##     0.010    0.055
##
##     0.036    0.152
##
##     0.043    0.240
##
##     0.071    0.233
##
##     0.056    0.320
##
##     0.103    0.351
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##     interc           3.450    0.040   85.745    0.000     3.371    3.529
##     slope            0.002    0.002    0.959    0.338    -0.002    0.005
##    .orderW1S1        0.000                                0.000    0.000
##    .orderW2S1        0.000                                0.000    0.000
##    .orderW3S1        0.000                                0.000    0.000
##    .orderW4S1        0.000                                0.000    0.000
##    .orderW1S2  (b)   1.053    0.185    5.697    0.000     0.691    1.415
##    .orderW2S2  (b)   1.053    0.185    5.697    0.000     0.691    1.415
##    .orderW3S2  (b)   1.053    0.185    5.697    0.000     0.691    1.415
##    .orderW4S2  (b)   1.053    0.185    5.697    0.000     0.691    1.415
##    .orderW1P1  (c)   0.552    0.336    1.643    0.100    -0.107    1.210
##    .orderW2P1  (c)   0.552    0.336    1.643    0.100    -0.107    1.210
##    .orderW3P1  (c)   0.552    0.336    1.643    0.100    -0.107    1.210
##    .orderW4P1  (c)   0.552    0.336    1.643    0.100    -0.107    1.210
```

```
##    .orderW1P2  (d)    1.553    0.266    5.839    0.000    1.031    2.074
##    .orderW2P2  (d)    1.553    0.266    5.839    0.000    1.031    2.074
##    .orderW3P2  (d)    1.553    0.266    5.839    0.000    1.031    2.074
##    .orderW4P2  (d)    1.553    0.266    5.839    0.000    1.031    2.074
##    .order1            0.000                               0.000    0.000
##    .order2            0.000                               0.000    0.000
##    .order3            0.000                               0.000    0.000
##    .order4            0.000                               0.000    0.000
##    Std.lv  Std.all
##    6.383    6.383
##    0.195    0.195
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    1.053    1.656
##    1.053    1.730
##    1.053    1.780
##    1.053    1.679
##    0.552    0.756
##    0.552    0.811
##    0.552    0.727
##    0.552    0.722
##    1.553    2.546
##    1.553    2.853
##    1.553    2.765
##    1.553    2.643
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##
## Variances:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .orderW1S1         0.208    0.036    5.689    0.000    0.136    0.279
##    .orderW1S2         0.230    0.026    8.886    0.000    0.180    0.281
##    .orderW1P1         0.355    0.044    8.141    0.000    0.270    0.441
##    .orderW1P2         0.281    0.033    8.400    0.000    0.215    0.346
##    .orderW2S1         0.164    0.031    5.357    0.000    0.104    0.224
##    .orderW2S2         0.193    0.023    8.255    0.000    0.148    0.239
##    .orderW2P1         0.282    0.039    7.326    0.000    0.207    0.358
##    .orderW2P2         0.204    0.028    7.201    0.000    0.148    0.259
##    .orderW3S1         0.181    0.030    6.062    0.000    0.122    0.239
##    .orderW3S2         0.182    0.022    8.392    0.000    0.139    0.224
##    .orderW3P1         0.404    0.052    7.767    0.000    0.302    0.506
##    .orderW3P2         0.228    0.030    7.653    0.000    0.169    0.286
##    .orderW4S1         0.166    0.047    3.528    0.000    0.074    0.258
##    .orderW4S2         0.182    0.031    5.966    0.000    0.123    0.242
##    .orderW4P1         0.369    0.051    7.276    0.000    0.269    0.468
##    .orderW4P2         0.235    0.034    6.890    0.000    0.168    0.302
##    .order1           -0.007    0.024   -0.298    0.765   -0.055    0.040
##    .order2           -0.011    0.015   -0.734    0.463   -0.040    0.018
##    .order3           -0.042    0.016   -2.580    0.010   -0.075   -0.010
##    .order4            0.006    0.034    0.190    0.849   -0.060    0.073
```

```
##     interc                 0.292    0.040    7.253    0.000    0.213    0.371
##     slope                  0.000    0.000    0.913    0.361   -0.000    0.000
##     Std.lv  Std.all
##     0.208    0.421
##     0.230    0.570
##     0.355    0.667
##     0.281    0.756
##     0.164    0.362
##     0.193    0.522
##     0.282    0.611
##     0.204    0.688
##     0.181    0.396
##     0.182    0.520
##     0.404    0.703
##     0.228    0.722
##     0.166    0.325
##     0.182    0.464
##     0.369    0.632
##     0.235    0.681
##    -0.025   -0.025
##    -0.037   -0.037
##    -0.154   -0.154
##     0.019    0.019
##     1.000    1.000
##     1.000    1.000
```

```r
semPaths(lgmOrder, what = "col", whatLabels = "est", intercepts = T)
```
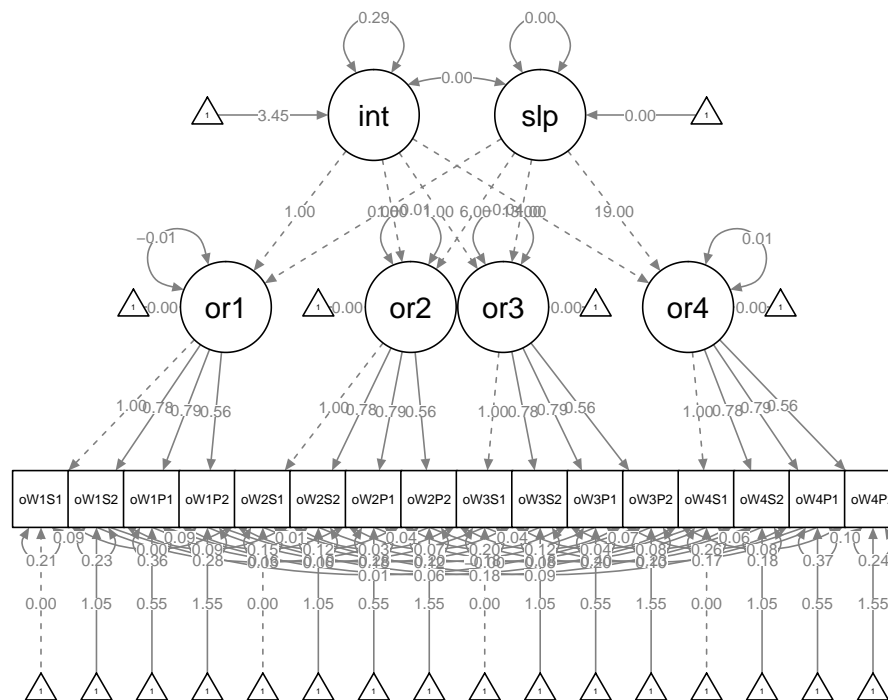
LGM Politeness

```
lgmPolit <- '

# factor at each time point with same loading
polit1 =~ politW1S1        + a * politW1S2 +
          peer * politW1P1 + aa * politW1P2

polit2 =~ politW2S1        + a * politW2S2 +
          peer * politW2P1 + aa * politW2P2

polit3 =~ politW3S1        + a * politW3S2 +
          peer * politW3P1 + aa * politW3P2

polit4 =~ politW4S1        + a * politW4S2 +
          peer * politW4P1 + aa * politW4P2

# second polit factor for intercept and slope
interc =~ 1*polit1 + 1*polit2 + 1*polit3 + 1*polit4
slope =~ 0*polit1 + 6*polit2 + 13*polit3 + 19*polit4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
```

```
politW1S1 ~ 0*1
politW2S1 ~ 0*1
politW3S1 ~ 0*1
politW4S1 ~ 0*1

# fix equal intercepts
politW1S2 ~ b*1
politW2S2 ~ b*1
politW3S2 ~ b*1
politW4S2 ~ b*1

politW1P1 ~ c*1
politW2P1 ~ c*1
politW3P1 ~ c*1
politW4P1 ~ c*1

politW1P2 ~ d*1
politW2P2 ~ d*1
politW3P2 ~ d*1
politW4P2 ~ d*1

# error covariance - similar parcels across waves
politW1S1 ~~ politW2S1 + politW3S1 + politW4S1
politW2S1 ~~ politW3S1 + politW4S1
politW3S1 ~~ politW4S1

politW1S2 ~~ politW2S2 + politW3S2 + politW4S2
politW2S2 ~~ politW3S2 + politW4S2
politW3S2 ~~ politW4S2

politW1P1 ~~ politW2P1 + politW3P1 + politW4P1
politW2P1 ~~ politW3P1 + politW4P1
politW3P1 ~~ politW4P1

politW1P2 ~~ politW2P2 + politW3P2 + politW4P2
politW2P2 ~~ politW3P2 + politW4P2
politW3P2 ~~ politW4P2

# error covariance - same method at one wave
politW1S1 ~~ politW1S2
politW1P1 ~~ politW1P2
politW2S1 ~~ politW2S2
politW2P1 ~~ politW2P2
politW3S1 ~~ politW3S2
politW3P1 ~~ politW3P2
politW4S1 ~~ politW4S2
politW4P1 ~~ politW4P2
'
lgmPolit <- sem(lgmPolit, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```r
summary(lgmPolit, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 158 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               170.613
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              1979.092
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.956
##   Tucker-Lewis Index (TLI)                       0.941
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1509.512
##   Loglikelihood unrestricted model (H1)      -1424.206
##
##   Akaike (AIC)                                3145.025
##   Bayesian (BIC)                              3369.105
##   Sample-size adjusted Bayesian (BIC)         3169.372
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.060
##   90 Percent confidence interval - lower         0.046
##   90 Percent confidence interval - upper         0.073
##   P-value RMSEA <= 0.05                          0.120
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.095
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
```

```
## 
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   polit1 =~
##     pltW1S1           1.000                                1.000    1.000
##     pltW1S2    (a)    0.851    0.093    9.178    0.000    0.669    1.033
##     pltW1P1 (peer)    1.110    0.126    8.807    0.000    0.863    1.356
##     pltW1P2   (aa)    1.273    0.142    8.980    0.000    0.995    1.551
##   polit2 =~
##     pltW2S1           1.000                                1.000    1.000
##     pltW2S2    (a)    0.851    0.093    9.178    0.000    0.669    1.033
##     pltW2P1 (peer)    1.110    0.126    8.807    0.000    0.863    1.356
##     pltW2P2   (aa)    1.273    0.142    8.980    0.000    0.995    1.551
##   polit3 =~
##     pltW3S1           1.000                                1.000    1.000
##     pltW3S2    (a)    0.851    0.093    9.178    0.000    0.669    1.033
##     pltW3P1 (peer)    1.110    0.126    8.807    0.000    0.863    1.356
##     pltW3P2   (aa)    1.273    0.142    8.980    0.000    0.995    1.551
##   polit4 =~
##     pltW4S1           1.000                                1.000    1.000
##     pltW4S2    (a)    0.851    0.093    9.178    0.000    0.669    1.033
##     pltW4P1 (peer)    1.110    0.126    8.807    0.000    0.863    1.356
##     pltW4P2   (aa)    1.273    0.142    8.980    0.000    0.995    1.551
##   interc =~
##     polit1            1.000                                1.000    1.000
##     polit2            1.000                                1.000    1.000
##     polit3            1.000                                1.000    1.000
##     polit4            1.000                                1.000    1.000
##   slope =~
##     polit1            0.000                                0.000    0.000
##     polit2            6.000                                6.000    6.000
##     polit3           13.000                               13.000   13.000
##     polit4           19.000                               19.000   19.000
##    Std.lv  Std.all
## 
##    0.392    0.603
##    0.334    0.584
##    0.435    0.699
##    0.500    0.786
## 
##    0.391    0.587
##    0.333    0.581
##    0.434    0.707
##    0.498    0.774
## 
##    0.411    0.622
##    0.350    0.580
##    0.456    0.697
##    0.524    0.783
## 
##    0.441    0.702
##    0.375    0.593
##    0.489    0.792
##    0.561    0.758
```

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```
##
##     0.980    0.980
##     0.983    0.983
##     0.935    0.935
##     0.873    0.873
##
##     0.000    0.000
##     0.172    0.172
##     0.354    0.354
##     0.484    0.484
##
## Covariances:
##                 Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope          0.000    0.001    0.492    0.623   -0.001    0.002
## .politW1S1 ~~
##    .politW2S1       0.189    0.027    7.088    0.000    0.137    0.242
##    .politW3S1       0.160    0.025    6.338    0.000    0.110    0.209
##    .politW4S1       0.137    0.024    5.779    0.000    0.090    0.183
## .politW2S1 ~~
##    .politW3S1       0.194    0.029    6.661    0.000    0.137    0.251
##    .politW4S1       0.144    0.027    5.340    0.000    0.091    0.197
## .politW3S1 ~~
##    .politW4S1       0.142    0.028    5.102    0.000    0.088    0.197
## .politW1S2 ~~
##    .politW2S2       0.089    0.020    4.405    0.000    0.049    0.128
##    .politW3S2       0.102    0.020    5.029    0.000    0.062    0.142
##    .politW4S2       0.093    0.023    4.051    0.000    0.048    0.137
## .politW2S2 ~~
##    .politW3S2       0.127    0.023    5.525    0.000    0.082    0.172
##    .politW4S2       0.131    0.025    5.236    0.000    0.082    0.180
## .politW3S2 ~~
##    .politW4S2       0.158    0.028    5.743    0.000    0.104    0.213
## .politW1P1 ~~
##    .politW2P1       0.077    0.019    4.071    0.000    0.040    0.114
##    .politW3P1       0.064    0.018    3.545    0.000    0.029    0.100
##    .politW4P1       0.069    0.021    3.326    0.001    0.028    0.109
## .politW2P1 ~~
##    .politW3P1       0.051    0.018    2.816    0.005    0.015    0.086
##    .politW4P1       0.063    0.022    2.843    0.004    0.020    0.107
## .politW3P1 ~~
##    .politW4P1       0.041    0.020    2.003    0.045    0.001    0.080
## .politW1P2 ~~
##    .politW2P2       0.005    0.021    0.254    0.799   -0.035    0.046
##    .politW3P2      -0.005    0.018   -0.282    0.778   -0.041    0.030
##    .politW4P2      -0.004    0.032   -0.135    0.893   -0.068    0.059
## .politW2P2 ~~
##    .politW3P2       0.032    0.020    1.594    0.111   -0.007    0.071
##    .politW4P2       0.049    0.027    1.829    0.067   -0.003    0.101
## .politW3P2 ~~
##    .politW4P2       0.075    0.026    2.906    0.004    0.024    0.126
## .politW1S1 ~~
##    .politW1S2       0.043    0.014    3.064    0.002    0.015    0.070
## .politW1P1 ~~
```

```
##    .politW1P2          0.069    0.023    3.007    0.003    0.024    0.113
## .politW2S1 ~~
##    .politW2S2          0.023    0.013    1.832    0.067   -0.002    0.048
## .politW2P1 ~~
##    .politW2P2          0.043    0.022    1.966    0.049    0.000    0.085
## .politW3S1 ~~
##    .politW3S2          0.034    0.013    2.563    0.010    0.008    0.061
## .politW3P1 ~~
##    .politW3P2          0.098    0.027    3.702    0.000    0.046    0.150
## .politW4S1 ~~
##    .politW4S2          0.008    0.016    0.505    0.613   -0.023    0.040
## .politW4P1 ~~
##    .politW4P2          0.041    0.029    1.416    0.157   -0.016    0.097
##    Std.lv  Std.all
##
##    0.086    0.086
##
##    0.189    0.676
##    0.160    0.594
##    0.137    0.590
##
##    0.194    0.692
##    0.144    0.596
##
##    0.142    0.614
##
##    0.089    0.409
##    0.102    0.449
##    0.093    0.392
##
##    0.127    0.554
##    0.131    0.550
##
##    0.158    0.633
##
##    0.077    0.399
##    0.064    0.306
##    0.069    0.408
##
##    0.051    0.250
##    0.063    0.387
##
##    0.041    0.230
##
##    0.005    0.033
##   -0.005   -0.031
##   -0.004   -0.023
##
##    0.032    0.189
##    0.049    0.247
##
##    0.075    0.374
##
##    0.043    0.178
```

```
## 
##     0.069     0.392
## 
##     0.023     0.091
## 
##     0.043     0.241
## 
##     0.034     0.135
## 
##     0.098     0.502
## 
##     0.008     0.036
## 
##     0.041     0.225
## 
## Intercepts:
##                     Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##      interc            3.829    0.039   98.639    0.000     3.753    3.905
##      slope             0.001    0.001    0.491    0.623    -0.002    0.003
##    .politW1S1          0.000                                0.000    0.000
##    .politW2S1          0.000                                0.000    0.000
##    .politW3S1          0.000                                0.000    0.000
##    .politW4S1          0.000                                0.000    0.000
##    .politW1S2  (b)     0.362    0.357    1.013    0.311    -0.338    1.062
##    .politW2S2  (b)     0.362    0.357    1.013    0.311    -0.338    1.062
##    .politW3S2  (b)     0.362    0.357    1.013    0.311    -0.338    1.062
##    .politW4S2  (b)     0.362    0.357    1.013    0.311    -0.338    1.062
##    .politW1P1  (c)    -0.638    0.486   -1.312    0.189    -1.591    0.315
##    .politW2P1  (c)    -0.638    0.486   -1.312    0.189    -1.591    0.315
##    .politW3P1  (c)    -0.638    0.486   -1.312    0.189    -1.591    0.315
##    .politW4P1  (c)    -0.638    0.486   -1.312    0.189    -1.591    0.315
##    .politW1P2  (d)    -0.905    0.546   -1.656    0.098    -1.976    0.166
##    .politW2P2  (d)    -0.905    0.546   -1.656    0.098    -1.976    0.166
##    .politW3P2  (d)    -0.905    0.546   -1.656    0.098    -1.976    0.166
##    .politW4P2  (d)    -0.905    0.546   -1.656    0.098    -1.976    0.166
##    .polit1             0.000                                0.000    0.000
##    .polit2             0.000                                0.000    0.000
##    .polit3             0.000                                0.000    0.000
##    .polit4             0.000                                0.000    0.000
##    Std.lv   Std.all
##    9.955     9.955
##    0.062     0.062
##    0.000     0.000
##    0.000     0.000
##    0.000     0.000
##    0.000     0.000
##    0.362     0.633
##    0.362     0.631
##    0.362     0.599
##    0.362     0.572
##   -0.638    -1.024
##   -0.638    -1.040
##   -0.638    -0.974
##   -0.638    -1.034
```

```
##     -0.905   -1.425
##     -0.905   -1.407
##     -0.905   -1.354
##     -0.905   -1.223
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     .politW1S1        0.270    0.029    9.363    0.000    0.213    0.326
##     .politW1S2        0.215    0.024    9.072    0.000    0.168    0.261
##     .politW1P1        0.199    0.030    6.669    0.000    0.140    0.257
##     .politW1P2        0.154    0.032    4.883    0.000    0.092    0.216
##     .politW2S1        0.292    0.034    8.664    0.000    0.226    0.358
##     .politW2S2        0.218    0.026    8.444    0.000    0.167    0.269
##     .politW2P1        0.188    0.029    6.520    0.000    0.132    0.245
##     .politW2P2        0.166    0.032    5.217    0.000    0.104    0.228
##     .politW3S1        0.268    0.032    8.426    0.000    0.206    0.331
##     .politW3S2        0.242    0.028    8.631    0.000    0.187    0.297
##     .politW3P1        0.221    0.033    6.662    0.000    0.156    0.286
##     .politW3P2        0.173    0.033    5.164    0.000    0.107    0.238
##     .politW4S1        0.200    0.031    6.428    0.000    0.139    0.260
##     .politW4S2        0.259    0.034    7.546    0.000    0.192    0.327
##     .politW4P1        0.142    0.032    4.434    0.000    0.079    0.204
##     .politW4P2        0.233    0.050    4.629    0.000    0.135    0.332
##     .polit1           0.006    0.012    0.511    0.609   -0.017    0.029
##     .polit2          -0.004    0.010   -0.406    0.685   -0.023    0.015
##     .polit3          -0.010    0.010   -0.911    0.362   -0.030    0.011
##     .polit4          -0.013    0.016   -0.819    0.413   -0.045    0.018
##      interc           0.148    0.030    4.912    0.000    0.089    0.207
##      slope            0.000    0.000    2.219    0.026    0.000    0.000
##    Std.lv   Std.all
##     0.270    0.636
##     0.215    0.658
##     0.199    0.512
##     0.154    0.381
##     0.292    0.656
##     0.218    0.663
##     0.188    0.500
##     0.166    0.401
##     0.268    0.613
##     0.242    0.664
##     0.221    0.515
##     0.173    0.386
##     0.200    0.507
##     0.259    0.649
##     0.142    0.372
##     0.233    0.426
##     0.039    0.039
##    -0.025   -0.025
##    -0.056   -0.056
##    -0.068   -0.068
```

```
##      1.000     1.000
##      1.000     1.000
```

```
semPaths(lgmPolit, what = "col", whatLabels = "est", intercepts = T)
```
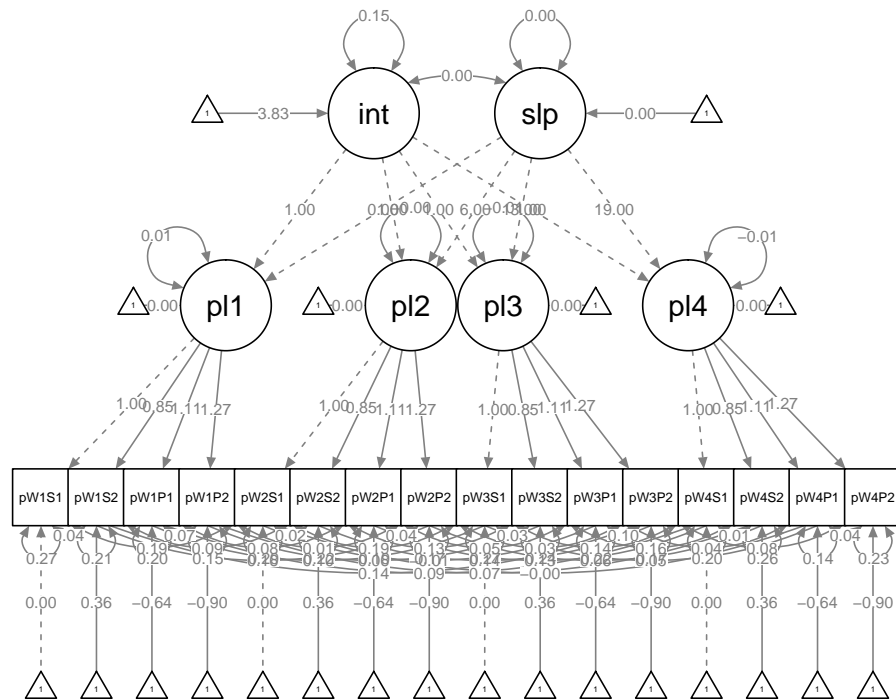

LGM Volatility

```
lgmVolat <- '

# factor at each time point with same loading
volat1 =~ volatW1S1       + a * volatW1S2 +
          peer * volatW1P1 + aa * volatW1P2

volat2 =~ volatW2S1       + a * volatW2S2 +
          peer * volatW2P1 + aa * volatW2P2

volat3 =~ volatW3S1       + a * volatW3S2 +
          peer * volatW3P1 + aa * volatW3P2

volat4 =~ volatW4S1       + a * volatW4S2 +
          peer * volatW4P1 + aa * volatW4P2

# second volat factor for intercept and slope
interc =~ 1*volat1 + 1*volat2 + 1*volat3 + 1*volat4
slope =~ 0*volat1 + 6*volat2 + 13*volat3 + 19*volat4
interc ~~ slope
```

```
interc ~ 1
slope ~ 1

# fix zero intercepts
volatW1S1 ~ 0*1
volatW2S1 ~ 0*1
volatW3S1 ~ 0*1
volatW4S1 ~ 0*1

# fix equal intercepts
volatW1S2 ~ b*1
volatW2S2 ~ b*1
volatW3S2 ~ b*1
volatW4S2 ~ b*1

volatW1P1 ~ c*1
volatW2P1 ~ c*1
volatW3P1 ~ c*1
volatW4P1 ~ c*1

volatW1P2 ~ d*1
volatW2P2 ~ d*1
volatW3P2 ~ d*1
volatW4P2 ~ d*1

# error covariance - similar parcels across waves
volatW1S1 ~~ volatW2S1 + volatW3S1 + volatW4S1
volatW2S1 ~~ volatW3S1 + volatW4S1
volatW3S1 ~~ volatW4S1

volatW1S2 ~~ volatW2S2 + volatW3S2 + volatW4S2
volatW2S2 ~~ volatW3S2 + volatW4S2
volatW3S2 ~~ volatW4S2

volatW1P1 ~~ volatW2P1 + volatW3P1 + volatW4P1
volatW2P1 ~~ volatW3P1 + volatW4P1
volatW3P1 ~~ volatW4P1

volatW1P2 ~~ volatW2P2 + volatW3P2 + volatW4P2
volatW2P2 ~~ volatW3P2 + volatW4P2
volatW3P2 ~~ volatW4P2

# error covariance - same method at one wave
volatW1S1 ~~ volatW1S2
volatW1P1 ~~ volatW1P2
volatW2S1 ~~ volatW2S2
volatW2P1 ~~ volatW2P2
volatW3S1 ~~ volatW3S2
volatW3P1 ~~ volatW3P2
volatW4S1 ~~ volatW4S2
volatW4P1 ~~ volatW4P2
'
lgmVolat <- sem(lgmVolat, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```r
summary(lgmVolat, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 143 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               342.462
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2829.311
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.906
##   Tucker-Lewis Index (TLI)                       0.874
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1825.531
##   Loglikelihood unrestricted model (H1)      -1654.300
##
##   Akaike (AIC)                                3777.062
##   Bayesian (BIC)                              4001.142
##   Sample-size adjusted Bayesian (BIC)         3801.409
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.105
##   90 Percent confidence interval - lower         0.093
##   90 Percent confidence interval - upper         0.117
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.192
##
## Parameter Estimates:
##
##   Standard errors                             Standard
```

```
##    Information                                  Observed
##    Observed information based on                Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   volat1 =~
##     vltW1S1            1.000                                1.000    1.000
##     vltW1S2     (a)    0.877    0.039   22.529    0.000    0.801    0.954
##     vltW1P1  (peer)    0.621    0.062   10.084    0.000    0.500    0.741
##     vltW1P2    (aa)    0.622    0.062   10.033    0.000    0.501    0.744
##   volat2 =~
##     vltW2S1            1.000                                1.000    1.000
##     vltW2S2     (a)    0.877    0.039   22.529    0.000    0.801    0.954
##     vltW2P1  (peer)    0.621    0.062   10.084    0.000    0.500    0.741
##     vltW2P2    (aa)    0.622    0.062   10.033    0.000    0.501    0.744
##   volat3 =~
##     vltW3S1            1.000                                1.000    1.000
##     vltW3S2     (a)    0.877    0.039   22.529    0.000    0.801    0.954
##     vltW3P1  (peer)    0.621    0.062   10.084    0.000    0.500    0.741
##     vltW3P2    (aa)    0.622    0.062   10.033    0.000    0.501    0.744
##   volat4 =~
##     vltW4S1            1.000                                1.000    1.000
##     vltW4S2     (a)    0.877    0.039   22.529    0.000    0.801    0.954
##     vltW4P1  (peer)    0.621    0.062   10.084    0.000    0.500    0.741
##     vltW4P2    (aa)    0.622    0.062   10.033    0.000    0.501    0.744
##   interc =~
##     volat1            1.000                                1.000    1.000
##     volat2            1.000                                1.000    1.000
##     volat3            1.000                                1.000    1.000
##     volat4            1.000                                1.000    1.000
##   slope =~
##     volat1            0.000                                0.000    0.000
##     volat2            6.000                                6.000    6.000
##     volat3           13.000                               13.000   13.000
##     volat4           19.000                               19.000   19.000
##    Std.lv  Std.all
##
##    0.656    0.754
##    0.575    0.732
##    0.407    0.502
##    0.408    0.503
##
##    0.672    0.806
##    0.589    0.800
##    0.417    0.576
##    0.418    0.573
##
##    0.592    0.758
##    0.519    0.695
##    0.367    0.433
##    0.368    0.481
##
##    0.565    0.643
##    0.495    0.643
```

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```
##     0.350    0.468
##     0.351    0.471
##
##     1.102    1.102
##     1.076    1.076
##     1.220    1.220
##     1.280    1.280
##
##     0.000    0.000
##     0.114    0.114
##     0.280    0.280
##     0.429    0.429
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##   interc ~~
##     slope           -0.002    0.002   -1.321    0.186    -0.006    0.001
##   .volatW1S1 ~~
##     .volatW2S1       0.032    0.021    1.517    0.129    -0.009    0.073
##     .volatW3S1       0.000    0.018    0.025    0.980    -0.036    0.037
##     .volatW4S1       0.039    0.024    1.632    0.103    -0.008    0.086
##   .volatW2S1 ~~
##     .volatW3S1       0.033    0.019    1.744    0.081    -0.004    0.069
##     .volatW4S1       0.018    0.024    0.759    0.448    -0.028    0.064
##   .volatW3S1 ~~
##     .volatW4S1       0.024    0.021    1.119    0.263    -0.018    0.066
##   .volatW1S2 ~~
##     .volatW2S2       0.043    0.017    2.614    0.009     0.011    0.076
##     .volatW3S2       0.059    0.017    3.566    0.000     0.027    0.091
##     .volatW4S2       0.033    0.019    1.774    0.076    -0.003    0.070
##   .volatW2S2 ~~
##     .volatW3S2       0.059    0.016    3.625    0.000     0.027    0.091
##     .volatW4S2       0.033    0.017    1.945    0.052    -0.000    0.067
##   .volatW3S2 ~~
##     .volatW4S2       0.040    0.017    2.339    0.019     0.006    0.073
##   .volatW1P1 ~~
##     .volatW2P1       0.029    0.022    1.276    0.202    -0.015    0.072
##     .volatW3P1      -0.038    0.025   -1.499    0.134    -0.087    0.012
##     .volatW4P1       0.028    0.025    1.136    0.256    -0.020    0.076
##   .volatW2P1 ~~
##     .volatW3P1       0.027    0.025    1.100    0.271    -0.021    0.076
##     .volatW4P1       0.052    0.025    2.087    0.037     0.003    0.100
##   .volatW3P1 ~~
##     .volatW4P1      -0.051    0.030   -1.690    0.091    -0.110    0.008
##   .volatW1P2 ~~
##     .volatW2P2       0.048    0.021    2.341    0.019     0.008    0.089
##     .volatW3P2       0.069    0.020    3.385    0.001     0.029    0.110
##     .volatW4P2       0.048    0.024    2.001    0.045     0.001    0.096
##   .volatW2P2 ~~
##     .volatW3P2       0.019    0.021    0.904    0.366    -0.022    0.061
##     .volatW4P2       0.046    0.024    1.903    0.057    -0.001    0.093
##   .volatW3P2 ~~
##     .volatW4P2       0.096    0.022    4.281    0.000     0.052    0.139
##   .volatW1S1 ~~
```

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```
##     .volatW1S2          0.172    0.046    3.742    0.000    0.082    0.262
## .volatW1P1 ~~
##     .volatW1P2          0.398    0.057    6.941    0.000    0.285    0.510
## .volatW2S1 ~~
##     .volatW2S2          0.087    0.040    2.196    0.028    0.009    0.164
## .volatW2P1 ~~
##     .volatW2P2          0.247    0.045    5.531    0.000    0.159    0.334
## .volatW3S1 ~~
##     .volatW3S2          0.176    0.040    4.361    0.000    0.097    0.255
## .volatW3P1 ~~
##     .volatW3P2          0.428    0.066    6.480    0.000    0.298    0.557
## .volatW4S1 ~~
##     .volatW4S2          0.274    0.064    4.294    0.000    0.149    0.398
## .volatW4P1 ~~
##     .volatW4P2          0.342    0.062    5.552    0.000    0.221    0.462
##    Std.lv  Std.all
##
##   -0.258   -0.258
##
##    0.032    0.113
##    0.000    0.002
##    0.039    0.101
##
##    0.033    0.129
##    0.018    0.054
##
##    0.024    0.070
##
##    0.043    0.183
##    0.059    0.205
##    0.033    0.106
##
##    0.059    0.247
##    0.033    0.128
##
##    0.040    0.125
##
##    0.029    0.069
##   -0.038   -0.070
##    0.028    0.060
##
##    0.027    0.060
##    0.052    0.132
##
##   -0.051   -0.101
##
##    0.048    0.115
##    0.069    0.147
##    0.048    0.104
##
##    0.019    0.048
##    0.046    0.116
##
##    0.096    0.216
```

```
## 
##     0.172     0.561
## 
##     0.398     0.808
## 
##     0.087     0.399
## 
##     0.247     0.698
## 
##     0.176     0.643
## 
##     0.428     0.832
## 
##     0.274     0.690
## 
##     0.342     0.785
## 
## Intercepts:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     interc             2.842    0.051   56.127    0.000    2.743    2.941
##     slope              0.000    0.002    0.100    0.920   -0.004    0.004
##     .volatW1S1         0.000                               0.000    0.000
##     .volatW2S1         0.000                               0.000    0.000
##     .volatW3S1         0.000                               0.000    0.000
##     .volatW4S1         0.000                               0.000    0.000
##     .volatW1S2  (b)    0.213    0.113    1.891    0.059   -0.008    0.434
##     .volatW2S2  (b)    0.213    0.113    1.891    0.059   -0.008    0.434
##     .volatW3S2  (b)    0.213    0.113    1.891    0.059   -0.008    0.434
##     .volatW4S2  (b)    0.213    0.113    1.891    0.059   -0.008    0.434
##     .volatW1P1  (c)    0.849    0.179    4.741    0.000    0.498    1.200
##     .volatW2P1  (c)    0.849    0.179    4.741    0.000    0.498    1.200
##     .volatW3P1  (c)    0.849    0.179    4.741    0.000    0.498    1.200
##     .volatW4P1  (c)    0.849    0.179    4.741    0.000    0.498    1.200
##     .volatW1P2  (d)    0.800    0.181    4.422    0.000    0.445    1.154
##     .volatW2P2  (d)    0.800    0.181    4.422    0.000    0.445    1.154
##     .volatW3P2  (d)    0.800    0.181    4.422    0.000    0.445    1.154
##     .volatW4P2  (d)    0.800    0.181    4.422    0.000    0.445    1.154
##     .volat1            0.000                               0.000    0.000
##     .volat2            0.000                               0.000    0.000
##     .volat3            0.000                               0.000    0.000
##     .volat4            0.000                               0.000    0.000
##    Std.lv  Std.all
##     3.933    3.933
##     0.016    0.016
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.213    0.271
##     0.213    0.289
##     0.213    0.285
##     0.213    0.277
##     0.849    1.048
##     0.849    1.174
```

```
##     0.849    1.000
##     0.849    1.135
##     0.800    0.985
##     0.800    1.096
##     0.800    1.045
##     0.800    1.072
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     .volatW1S1        0.327    0.055    5.971    0.000     0.220     0.434
##     .volatW1S2        0.287    0.045    6.313    0.000     0.198     0.376
##     .volatW1P1        0.491    0.063    7.845    0.000     0.368     0.614
##     .volatW1P2        0.493    0.059    8.315    0.000     0.377     0.609
##     .volatW2S1        0.243    0.049    4.984    0.000     0.148     0.339
##     .volatW2S2        0.195    0.039    5.047    0.000     0.119     0.271
##     .volatW2P1        0.350    0.047    7.436    0.000     0.258     0.442
##     .volatW2P2        0.358    0.047    7.644    0.000     0.266     0.449
##     .volatW3S1        0.260    0.047    5.501    0.000     0.167     0.352
##     .volatW3S2        0.290    0.040    7.232    0.000     0.211     0.368
##     .volatW3P1        0.586    0.084    7.005    0.000     0.422     0.750
##     .volatW3P2        0.450    0.059    7.591    0.000     0.334     0.567
##     .volatW4S1        0.452    0.076    5.927    0.000     0.303     0.602
##     .volatW4S2        0.347    0.059    5.848    0.000     0.231     0.464
##     .volatW4P1        0.437    0.067    6.517    0.000     0.306     0.569
##     .volatW4P2        0.433    0.061    7.076    0.000     0.313     0.553
##     .volat1          -0.092    0.047   -1.954    0.051    -0.185     0.000
##     .volat2          -0.048    0.039   -1.225    0.220    -0.125     0.029
##     .volat3          -0.137    0.040   -3.439    0.001    -0.215    -0.059
##     .volat4          -0.172    0.060   -2.874    0.004    -0.289    -0.055
##      interc           0.522    0.060    8.693    0.000     0.405     0.640
##      slope            0.000    0.000    1.406    0.160    -0.000     0.000
##     Std.lv   Std.all
##      0.327    0.432
##      0.287    0.464
##      0.491    0.748
##      0.493    0.747
##      0.243    0.350
##      0.195    0.360
##      0.350    0.668
##      0.358    0.672
##      0.260    0.426
##      0.290    0.518
##      0.586    0.813
##      0.450    0.768
##      0.452    0.586
##      0.347    0.586
##      0.437    0.781
##      0.433    0.778
##     -0.214   -0.214
##     -0.107   -0.107
```

```
##     -0.391    -0.391
##     -0.538    -0.538
##      1.000     1.000
##      1.000     1.000
```

```r
semPaths(lgmVolat, what = "col", whatLabels = "est", intercepts = T)
```
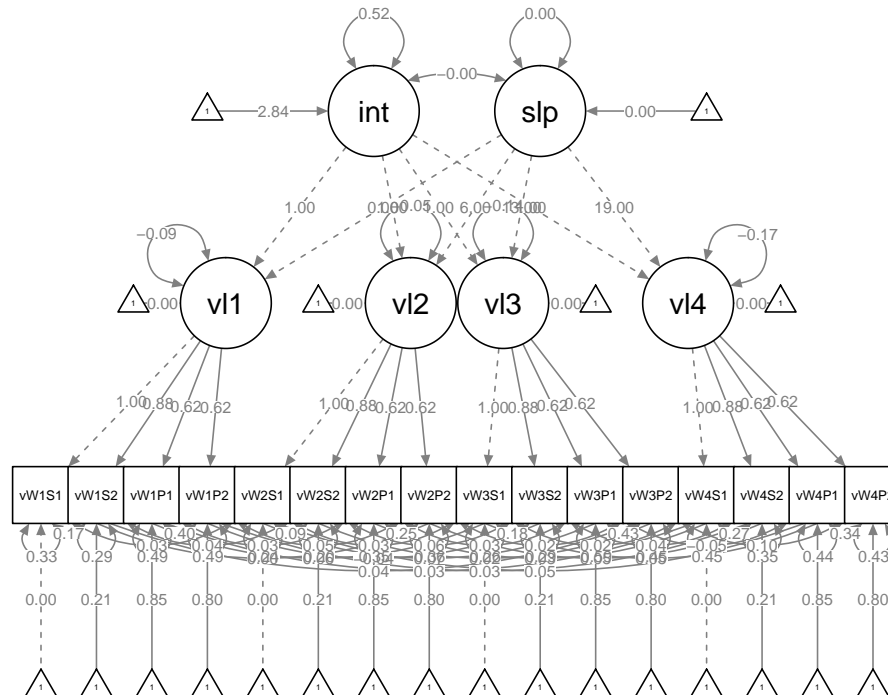

LGM Withdrawal

```r
lgmWithd <- '

# factor at each time point with same loading
withd1 =~ withdW1S1        + a * withdW1S2 +
          peer * withdW1P1 + aa * withdW1P2

withd2 =~ withdW2S1        + a * withdW2S2 +
          peer * withdW2P1 + aa * withdW2P2

withd3 =~ withdW3S1        + a * withdW3S2 +
          peer * withdW3P1 + aa * withdW3P2

withd4 =~ withdW4S1        + a * withdW4S2 +
          peer * withdW4P1 + aa * withdW4P2


# second withd factor for intercept and slope
interc =~ 1*withd1 + 1*withd2 + 1*withd3 + 1*withd4
```

```
slope =~ 0*withd1 + 6*withd2 + 13*withd3 + 19*withd4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
withdW1S1 ~ 0*1
withdW2S1 ~ 0*1
withdW3S1 ~ 0*1
withdW4S1 ~ 0*1

# fix equal intercepts
withdW1S2 ~ b*1
withdW2S2 ~ b*1
withdW3S2 ~ b*1
withdW4S2 ~ b*1

withdW1P1 ~ c*1
withdW2P1 ~ c*1
withdW3P1 ~ c*1
withdW4P1 ~ c*1

withdW1P2 ~ d*1
withdW2P2 ~ d*1
withdW3P2 ~ d*1
withdW4P2 ~ d*1

# error covariance - similar parcels across waves
withdW1S1 ~~ withdW2S1 + withdW3S1 + withdW4S1
withdW2S1 ~~ withdW3S1 + withdW4S1
withdW3S1 ~~ withdW4S1

withdW1S2 ~~ withdW2S2 + withdW3S2 + withdW4S2
withdW2S2 ~~ withdW3S2 + withdW4S2
withdW3S2 ~~ withdW4S2

withdW1P1 ~~ withdW2P1 + withdW3P1 + withdW4P1
withdW2P1 ~~ withdW3P1 + withdW4P1
withdW3P1 ~~ withdW4P1

withdW1P2 ~~ withdW2P2 + withdW3P2 + withdW4P2
withdW2P2 ~~ withdW3P2 + withdW4P2
withdW3P2 ~~ withdW4P2

# error covariance - same method at one wave
withdW1S1 ~~ withdW1S2
withdW1P1 ~~ withdW1P2
withdW2S1 ~~ withdW2S2
withdW2P1 ~~ withdW2P2
withdW3S1 ~~ withdW3S2
withdW3P1 ~~ withdW3P2
withdW4S1 ~~ withdW4S2
withdW4P1 ~~ withdW4P2
```

```
'
lgmWithd <- sem(lgmWithd, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lgmWithd, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 160 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               322.713
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2333.668
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.894
##   Tucker-Lewis Index (TLI)                       0.858
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1793.040
##   Loglikelihood unrestricted model (H1)      -1631.683
##
##   Akaike (AIC)                                3712.080
##   Bayesian (BIC)                              3936.160
##   Sample-size adjusted Bayesian (BIC)         3736.427
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.101
##   90 Percent confidence interval - lower         0.089
##   90 Percent confidence interval - upper         0.113
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.167
```

```
##
## Parameter Estimates:
##
##   Standard errors                          Standard
##   Information                              Observed
##   Observed information based on            Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   withd1 =~
##     wthW1S1            1.000                                    1.000    1.000
##     wthW1S2    (a)     0.926    0.067   13.863    0.000    0.795    1.057
##     wthW1P1 (peer)     0.684    0.139    4.924    0.000    0.412    0.956
##     wthW1P2   (aa)     0.648    0.141    4.598    0.000    0.372    0.924
##   withd2 =~
##     wthW2S1            1.000                                    1.000    1.000
##     wthW2S2    (a)     0.926    0.067   13.863    0.000    0.795    1.057
##     wthW2P1 (peer)     0.684    0.139    4.924    0.000    0.412    0.956
##     wthW2P2   (aa)     0.648    0.141    4.598    0.000    0.372    0.924
##   withd3 =~
##     wthW3S1            1.000                                    1.000    1.000
##     wthW3S2    (a)     0.926    0.067   13.863    0.000    0.795    1.057
##     wthW3P1 (peer)     0.684    0.139    4.924    0.000    0.412    0.956
##     wthW3P2   (aa)     0.648    0.141    4.598    0.000    0.372    0.924
##   withd4 =~
##     wthW4S1            1.000                                    1.000    1.000
##     wthW4S2    (a)     0.926    0.067   13.863    0.000    0.795    1.057
##     wthW4P1 (peer)     0.684    0.139    4.924    0.000    0.412    0.956
##     wthW4P2   (aa)     0.648    0.141    4.598    0.000    0.372    0.924
##   interc =~
##     withd1            1.000                                    1.000    1.000
##     withd2            1.000                                    1.000    1.000
##     withd3            1.000                                    1.000    1.000
##     withd4            1.000                                    1.000    1.000
##   slope =~
##     withd1            0.000                                    0.000    0.000
##     withd2            6.000                                    6.000    6.000
##     withd3           13.000                                   13.000   13.000
##     withd4           19.000                                   19.000   19.000
##    Std.lv  Std.all
##
##    0.559    0.732
##    0.518    0.710
##    0.382    0.565
##    0.362    0.508
##
##    0.578    0.766
##    0.535    0.751
##    0.395    0.592
##    0.374    0.572
##
##    0.566    0.745
##    0.524    0.757
##    0.387    0.546
```

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```
##     0.366    0.546
##
##     0.549    0.724
##     0.508    0.754
##     0.375    0.553
##     0.355    0.550
##
##     1.053    1.053
##     1.019    1.019
##     1.041    1.041
##     1.073    1.073
##
##     0.000    0.000
##     0.131    0.131
##     0.291    0.291
##     0.438    0.438
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope            -0.003    0.002   -1.711    0.087   -0.006    0.000
##  .withdW1S1 ~~
##    .withdW2S1         0.058    0.027    2.154    0.031    0.005    0.111
##    .withdW3S1         0.067    0.029    2.294    0.022    0.010    0.124
##    .withdW4S1         0.078    0.029    2.646    0.008    0.020    0.135
##  .withdW2S1 ~~
##    .withdW3S1         0.092    0.035    2.633    0.008    0.023    0.160
##    .withdW4S1         0.075    0.033    2.261    0.024    0.010    0.139
##  .withdW3S1 ~~
##    .withdW4S1         0.101    0.038    2.660    0.008    0.027    0.175
##  .withdW1S2 ~~
##    .withdW2S2         0.097    0.025    3.818    0.000    0.047    0.146
##    .withdW3S2         0.106    0.024    4.342    0.000    0.058    0.154
##    .withdW4S2         0.085    0.025    3.404    0.001    0.036    0.134
##  .withdW2S2 ~~
##    .withdW3S2         0.100    0.025    3.934    0.000    0.050    0.149
##    .withdW4S2         0.091    0.026    3.503    0.000    0.040    0.142
##  .withdW3S2 ~~
##    .withdW4S2         0.108    0.027    4.027    0.000    0.055    0.161
##  .withdW1P1 ~~
##    .withdW2P1         0.143    0.052    2.756    0.006    0.041    0.245
##    .withdW3P1         0.187    0.063    2.950    0.003    0.063    0.312
##    .withdW4P1         0.165    0.052    3.162    0.002    0.063    0.268
##  .withdW2P1 ~~
##    .withdW3P1         0.209    0.057    3.631    0.000    0.096    0.321
##    .withdW4P1         0.189    0.053    3.563    0.000    0.085    0.293
##  .withdW3P1 ~~
##    .withdW4P1         0.206    0.066    3.116    0.002    0.077    0.336
##  .withdW1P2 ~~
##    .withdW2P2         0.193    0.052    3.719    0.000    0.091    0.295
##    .withdW3P2         0.217    0.061    3.582    0.000    0.098    0.336
##    .withdW4P2         0.158    0.056    2.800    0.005    0.047    0.269
##  .withdW2P2 ~~
##    .withdW3P2         0.211    0.055    3.809    0.000    0.102    0.319
```

```
##     .withdW4P2          0.126    0.050    2.507    0.012    0.028    0.225
## .withdW3P2 ~~
##     .withdW4P2          0.197    0.059    3.343    0.001    0.081    0.312
## .withdW1S1 ~~
##     .withdW1S2          0.108    0.033    3.232    0.001    0.042    0.173
## .withdW1P1 ~~
##     .withdW1P2          0.096    0.027    3.590    0.000    0.044    0.149
## .withdW2S1 ~~
##     .withdW2S2          0.060    0.026    2.346    0.019    0.010    0.110
## .withdW2P1 ~~
##     .withdW2P2          0.032    0.020    1.565    0.118   -0.008    0.071
## .withdW3S1 ~~
##     .withdW3S2          0.034    0.022    1.538    0.124   -0.009    0.078
## .withdW3P1 ~~
##     .withdW3P2          0.021    0.027    0.803    0.422   -0.031    0.074
## .withdW4S1 ~~
##     .withdW4S2          0.045    0.031    1.446    0.148   -0.016    0.105
## .withdW4P1 ~~
##     .withdW4P2          0.093    0.031    3.041    0.002    0.033    0.153
##    Std.lv  Std.all
##
##   -0.354   -0.354
##
##    0.058    0.231
##    0.067    0.254
##    0.078    0.285
##
##    0.092    0.374
##    0.075    0.295
##
##    0.101    0.381
##
##    0.097    0.401
##    0.106    0.459
##    0.085    0.373
##
##    0.100    0.468
##    0.091    0.436
##
##    0.108    0.539
##
##    0.143    0.477
##    0.187    0.566
##    0.165    0.525
##
##    0.209    0.652
##    0.189    0.620
##
##    0.206    0.615
##
##    0.193    0.586
##    0.217    0.632
##    0.158    0.478
##
```

```
##    0.211    0.699
##    0.126    0.436
##
##    0.197    0.649
##
##    0.108    0.404
##
##    0.096    0.281
##
##    0.060    0.263
##
##    0.032    0.109
##
##    0.034    0.151
##
##    0.021    0.064
##
##    0.045    0.192
##
##    0.093    0.306
##
## Intercepts:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      interc            2.973    0.045   66.207    0.000    2.885    3.061
##      slope            -0.000    0.002   -0.034    0.973   -0.004    0.004
##    .withdW1S1          0.000                               0.000    0.000
##    .withdW2S1          0.000                               0.000    0.000
##    .withdW3S1          0.000                               0.000    0.000
##    .withdW4S1          0.000                               0.000    0.000
##    .withdW1S2  (b)     0.265    0.201    1.316    0.188   -0.129    0.659
##    .withdW2S2  (b)     0.265    0.201    1.316    0.188   -0.129    0.659
##    .withdW3S2  (b)     0.265    0.201    1.316    0.188   -0.129    0.659
##    .withdW4S2  (b)     0.265    0.201    1.316    0.188   -0.129    0.659
##    .withdW1P1  (c)     0.580    0.417    1.392    0.164   -0.237    1.396
##    .withdW2P1  (c)     0.580    0.417    1.392    0.164   -0.237    1.396
##    .withdW3P1  (c)     0.580    0.417    1.392    0.164   -0.237    1.396
##    .withdW4P1  (c)     0.580    0.417    1.392    0.164   -0.237    1.396
##    .withdW1P2  (d)     0.620    0.421    1.473    0.141   -0.205    1.445
##    .withdW2P2  (d)     0.620    0.421    1.473    0.141   -0.205    1.445
##    .withdW3P2  (d)     0.620    0.421    1.473    0.141   -0.205    1.445
##    .withdW4P2  (d)     0.620    0.421    1.473    0.141   -0.205    1.445
##    .withd1             0.000                               0.000    0.000
##    .withd2             0.000                               0.000    0.000
##    .withd3             0.000                               0.000    0.000
##    .withd4             0.000                               0.000    0.000
##    Std.lv  Std.all
##    5.050    5.050
##   -0.005   -0.005
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.265    0.363
##    0.265    0.371
```

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```
##     0.265    0.382
##     0.265    0.392
##     0.580    0.858
##     0.580    0.868
##     0.580    0.819
##     0.580    0.855
##     0.620    0.871
##     0.620    0.947
##     0.620    0.925
##     0.620    0.960
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .withdW1S1       0.271    0.047    5.748    0.000    0.178    0.363
##     .withdW1S2       0.263    0.042    6.232    0.000    0.180    0.346
##     .withdW1P1       0.311    0.048    6.452    0.000    0.217    0.405
##     .withdW1P2       0.376    0.056    6.720    0.000    0.266    0.486
##     .withdW2S1       0.235    0.046    5.128    0.000    0.145    0.324
##     .withdW2S2       0.222    0.039    5.619    0.000    0.144    0.299
##     .withdW2P1       0.290    0.054    5.420    0.000    0.185    0.395
##     .withdW2P2       0.289    0.055    5.289    0.000    0.182    0.395
##     .withdW3S1       0.256    0.053    4.871    0.000    0.153    0.359
##     .withdW3S2       0.204    0.036    5.701    0.000    0.134    0.274
##     .withdW3P1       0.352    0.067    5.270    0.000    0.221    0.483
##     .withdW3P2       0.315    0.061    5.194    0.000    0.196    0.434
##     .withdW4S1       0.273    0.055    4.943    0.000    0.165    0.382
##     .withdW4S2       0.197    0.041    4.852    0.000    0.117    0.276
##     .withdW4P1       0.319    0.055    5.787    0.000    0.211    0.427
##     .withdW4P2       0.291    0.050    5.771    0.000    0.192    0.390
##     .withd1         -0.034    0.028   -1.202    0.229   -0.090    0.022
##     .withd2          0.013    0.022    0.612    0.540   -0.029    0.056
##     .withd3          0.015    0.019    0.784    0.433   -0.022    0.051
##     .withd4         -0.003    0.031   -0.102    0.919   -0.063    0.057
##      interc          0.347    0.057    6.128    0.000    0.236    0.458
##      slope           0.000    0.000    1.601    0.109   -0.000    0.000
##    Std.lv  Std.all
##     0.271    0.464
##     0.263    0.495
##     0.311    0.680
##     0.376    0.742
##     0.235    0.412
##     0.222    0.436
##     0.290    0.650
##     0.289    0.673
##     0.256    0.445
##     0.204    0.427
##     0.352    0.702
##     0.315    0.701
##     0.273    0.476
##     0.197    0.432
```

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```
##      0.319      0.694
##      0.291      0.697
##     -0.109     -0.109
##      0.040      0.040
##      0.045      0.045
##     -0.010     -0.010
##      1.000      1.000
##      1.000      1.000
```

```
semPaths(lgmWithd, what = "col", whatLabels = "est", intercepts = T)
```
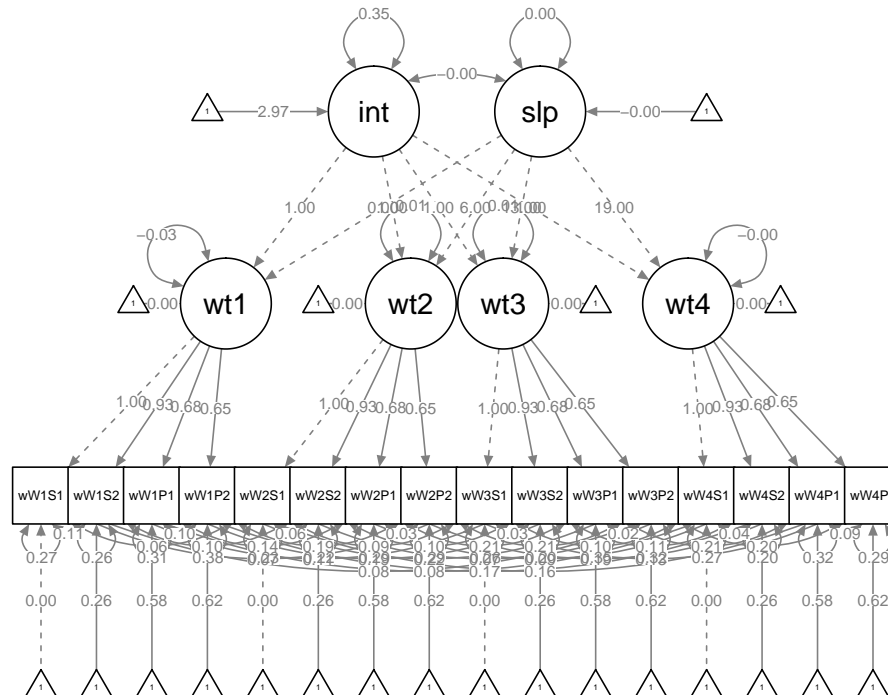

LGM Confusion

```
lgmConfu <- '

# factor at each time point with same loading
confu1 =~ confuW1S1        + a * confuW1S2 +
         peer * confuW1P1 + aa * confuW1P2

confu2 =~ confuW2S1        + a * confuW2S2 +
         peer * confuW2P1 + aa * confuW2P2

confu3 =~ confuW3S1        + a * confuW3S2 +
         peer * confuW3P1 + aa * confuW3P2

confu4 =~ confuW4S1        + a * confuW4S2 +
```

```
          peer * confuW4P1 + aa * confuW4P2

# second confu factor for intercept and slope
interc =~ 1*confu1 + 1*confu2 + 1*confu3 + 1*confu4
slope =~ 0*confu1 + 6*confu2 + 13*confu3 + 19*confu4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
confuW1S1 ~ 0*1
confuW2S1 ~ 0*1
confuW3S1 ~ 0*1
confuW4S1 ~ 0*1

# fix equal intercepts
confuW1S2 ~ b*1
confuW2S2 ~ b*1
confuW3S2 ~ b*1
confuW4S2 ~ b*1

confuW1P1 ~ c*1
confuW2P1 ~ c*1
confuW3P1 ~ c*1
confuW4P1 ~ c*1

confuW1P2 ~ d*1
confuW2P2 ~ d*1
confuW3P2 ~ d*1
confuW4P2 ~ d*1

# error covariance - similar parcels across waves
confuW1S1 ~~ confuW2S1 + confuW3S1 + confuW4S1
confuW2S1 ~~ confuW3S1 + confuW4S1
confuW3S1 ~~ confuW4S1

confuW1S2 ~~ confuW2S2 + confuW3S2 + confuW4S2
confuW2S2 ~~ confuW3S2 + confuW4S2
confuW3S2 ~~ confuW4S2

confuW1P1 ~~ confuW2P1 + confuW3P1 + confuW4P1
confuW2P1 ~~ confuW3P1 + confuW4P1
confuW3P1 ~~ confuW4P1

confuW1P2 ~~ confuW2P2 + confuW3P2 + confuW4P2
confuW2P2 ~~ confuW3P2 + confuW4P2
confuW3P2 ~~ confuW4P2

# error covariance - same method at one wave
confuW1S1 ~~ confuW1S2
confuW1P1 ~~ confuW1P2
confuW2S1 ~~ confuW2S2
confuW2P1 ~~ confuW2P2
```

```
confuW3S1 ~~ confuW3S2
confuW3P1 ~~ confuW3P2
confuW4S1 ~~ confuW4S2
confuW4P1 ~~ confuW4P2
'
lgmConfu <- sem(lgmConfu, data = data, missing = "ML")
```

Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
variances are negative

```
summary(lgmConfu, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 135 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         81
##   Number of equality constraints                    18
##
##   Number of observations                           259
##   Number of missing patterns                        55
##
## Model Test User Model:
##
##   Test statistic                               181.006
##   Degrees of freedom                                89
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              1406.278
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.928
##   Tucker-Lewis Index (TLI)                       0.904
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -2233.611
##   Loglikelihood unrestricted model (H1)      -2143.108
##
##   Akaike (AIC)                                4593.222
##   Bayesian (BIC)                              4817.302
##   Sample-size adjusted Bayesian (BIC)         4617.570
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.063
##   90 Percent confidence interval - lower         0.050
##   90 Percent confidence interval - upper         0.076
##   P-value RMSEA <= 0.05                          0.051
```

```
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                          0.108
##
## Parameter Estimates:
##
##    Standard errors                             Standard
##    Information                                 Observed
##    Observed information based on                Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   confu1 =~
##     cnfW1S1            1.000                                1.000    1.000
##     cnfW1S2    (a)     1.092    0.114    9.607    0.000    0.869    1.315
##     cnfW1P1 (peer)     0.997    0.171    5.813    0.000    0.661    1.333
##     cnfW1P2   (aa)     0.777    0.149    5.223    0.000    0.485    1.068
##   confu2 =~
##     cnfW2S1            1.000                                1.000    1.000
##     cnfW2S2    (a)     1.092    0.114    9.607    0.000    0.869    1.315
##     cnfW2P1 (peer)     0.997    0.171    5.813    0.000    0.661    1.333
##     cnfW2P2   (aa)     0.777    0.149    5.223    0.000    0.485    1.068
##   confu3 =~
##     cnfW3S1            1.000                                1.000    1.000
##     cnfW3S2    (a)     1.092    0.114    9.607    0.000    0.869    1.315
##     cnfW3P1 (peer)     0.997    0.171    5.813    0.000    0.661    1.333
##     cnfW3P2   (aa)     0.777    0.149    5.223    0.000    0.485    1.068
##   confu4 =~
##     cnfW4S1            1.000                                1.000    1.000
##     cnfW4S2    (a)     1.092    0.114    9.607    0.000    0.869    1.315
##     cnfW4P1 (peer)     0.997    0.171    5.813    0.000    0.661    1.333
##     cnfW4P2   (aa)     0.777    0.149    5.223    0.000    0.485    1.068
##   interc =~
##     confu1            1.000                                1.000    1.000
##     confu2            1.000                                1.000    1.000
##     confu3            1.000                                1.000    1.000
##     confu4            1.000                                1.000    1.000
##   slope =~
##     confu1            0.000                                0.000    0.000
##     confu2            6.000                                6.000    6.000
##     confu3           13.000                               13.000   13.000
##     confu4           19.000                               19.000   19.000
##    Std.lv  Std.all
##
##    0.409    0.526
##    0.446    0.574
##    0.407    0.482
##    0.317    0.490
##
##    0.440    0.590
##    0.480    0.609
##    0.438    0.604
##    0.341    0.512
```

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```
##
##     0.450    0.577
##     0.491    0.593
##     0.448    0.631
##     0.349    0.521
##
##     0.448    0.587
##     0.489    0.615
##     0.447    0.597
##     0.348    0.474
##
##     1.186    1.186
##     1.103    1.103
##     1.078    1.078
##     1.082    1.082
##
##     0.000    0.000
##     0.222    0.222
##     0.470    0.470
##     0.689    0.689
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   interc ~~
##     slope            -0.003    0.002   -1.739    0.082   -0.006    0.000
##  .confuW1S1 ~~
##    .confuW2S1         0.087    0.032    2.730    0.006    0.025    0.150
##    .confuW3S1         0.088    0.032    2.778    0.005    0.026    0.150
##    .confuW4S1         0.130    0.034    3.776    0.000    0.063    0.198
##  .confuW2S1 ~~
##    .confuW3S1         0.102    0.034    2.985    0.003    0.035    0.169
##    .confuW4S1         0.115    0.035    3.267    0.001    0.046    0.184
##  .confuW3S1 ~~
##    .confuW4S1         0.126    0.037    3.449    0.001    0.055    0.198
##  .confuW1S2 ~~
##    .confuW2S2         0.077    0.036    2.120    0.034    0.006    0.148
##    .confuW3S2         0.065    0.034    1.934    0.053   -0.001    0.131
##    .confuW4S2         0.037    0.037    1.019    0.308   -0.035    0.109
##  .confuW2S2 ~~
##    .confuW3S2         0.157    0.040    3.951    0.000    0.079    0.235
##    .confuW4S2         0.101    0.043    2.321    0.020    0.016    0.186
##  .confuW3S2 ~~
##    .confuW4S2         0.141    0.046    3.064    0.002    0.051    0.231
##  .confuW1P1 ~~
##    .confuW2P1         0.166    0.054    3.067    0.002    0.060    0.273
##    .confuW3P1         0.195    0.052    3.723    0.000    0.092    0.298
##    .confuW4P1         0.161    0.061    2.624    0.009    0.041    0.282
##  .confuW2P1 ~~
##    .confuW3P1         0.124    0.051    2.413    0.016    0.023    0.224
##    .confuW4P1         0.138    0.057    2.428    0.015    0.027    0.249
##  .confuW3P1 ~~
##    .confuW4P1         0.160    0.056    2.865    0.004    0.051    0.270
##  .confuW1P2 ~~
##    .confuW2P2         0.148    0.039    3.751    0.000    0.070    0.225
```

```
##    .confuW3P2              0.114    0.038    2.993    0.003    0.039    0.189
##    .confuW4P2              0.220    0.047    4.709    0.000    0.129    0.312
## .confuW2P2 ~~
##    .confuW3P2              0.181    0.043    4.215    0.000    0.097    0.265
##    .confuW4P2              0.215    0.048    4.502    0.000    0.121    0.308
## .confuW3P2 ~~
##    .confuW4P2              0.184    0.048    3.825    0.000    0.090    0.278
## .confuW1S1 ~~
##    .confuW1S2              0.157    0.039    3.989    0.000    0.080    0.235
## .confuW1P1 ~~
##    .confuW1P2              0.116    0.035    3.293    0.001    0.047    0.186
## .confuW2S1 ~~
##    .confuW2S2              0.083    0.035    2.414    0.016    0.016    0.151
## .confuW2P1 ~~
##    .confuW2P2              0.059    0.029    2.010    0.044    0.001    0.117
## .confuW3S1 ~~
##    .confuW3S2              0.154    0.040    3.831    0.000    0.075    0.233
## .confuW3P1 ~~
##    .confuW3P2              0.068    0.032    2.127    0.033    0.005    0.131
## .confuW4S1 ~~
##    .confuW4S2              0.093    0.048    1.940    0.052   -0.001    0.186
## .confuW4P1 ~~
##    .confuW4P2              0.066    0.041    1.612    0.107   -0.014    0.146
##    Std.lv  Std.all
##
##   -0.356   -0.356
##
##    0.087    0.221
##    0.088    0.210
##    0.130    0.320
##
##    0.102    0.268
##    0.115    0.311
##
##    0.126    0.322
##
##    0.077    0.193
##    0.065    0.153
##    0.037    0.094
##
##    0.157    0.378
##    0.101    0.257
##
##    0.141    0.337
##
##    0.166    0.388
##    0.195    0.477
##    0.161    0.363
##
##    0.124    0.388
##    0.138    0.397
##
##    0.160    0.485
##
```

```
##     0.148    0.455
##     0.114    0.353
##     0.220    0.603
##
##     0.181    0.552
##     0.215    0.579
##
##     0.184    0.497
##
##     0.157    0.375
##
##     0.116    0.278
##
##     0.083    0.222
##
##     0.059    0.179
##
##     0.154    0.364
##
##     0.068    0.216
##
##     0.093    0.239
##
##     0.066    0.169
##
## Intercepts:
##                     Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     interc             2.852    0.043   65.956    0.000     2.768     2.937
##     slope             -0.004    0.002   -1.728    0.084    -0.008     0.001
##   .confuW1S1           0.000                                0.000     0.000
##   .confuW2S1           0.000                                0.000     0.000
##   .confuW3S1           0.000                                0.000     0.000
##   .confuW4S1           0.000                                0.000     0.000
##   .confuW1S2   (b)    -0.207    0.323   -0.641    0.522    -0.839     0.426
##   .confuW2S2   (b)    -0.207    0.323   -0.641    0.522    -0.839     0.426
##   .confuW3S2   (b)    -0.207    0.323   -0.641    0.522    -0.839     0.426
##   .confuW4S2   (b)    -0.207    0.323   -0.641    0.522    -0.839     0.426
##   .confuW1P1   (c)    -0.378    0.489   -0.773    0.439    -1.336     0.580
##   .confuW2P1   (c)    -0.378    0.489   -0.773    0.439    -1.336     0.580
##   .confuW3P1   (c)    -0.378    0.489   -0.773    0.439    -1.336     0.580
##   .confuW4P1   (c)    -0.378    0.489   -0.773    0.439    -1.336     0.580
##   .confuW1P2   (d)     0.294    0.423    0.697    0.486    -0.534     1.123
##   .confuW2P2   (d)     0.294    0.423    0.697    0.486    -0.534     1.123
##   .confuW3P2   (d)     0.294    0.423    0.697    0.486    -0.534     1.123
##   .confuW4P2   (d)     0.294    0.423    0.697    0.486    -0.534     1.123
##   .confu1              0.000                                0.000     0.000
##   .confu2              0.000                                0.000     0.000
##   .confu3              0.000                                0.000     0.000
##   .confu4              0.000                                0.000     0.000
##    Std.lv   Std.all
##     5.884     5.884
##    -0.232    -0.232
##     0.000     0.000
##     0.000     0.000
```

```
##     0.000     0.000
##     0.000     0.000
##    -0.207    -0.266
##    -0.207    -0.262
##    -0.207    -0.250
##    -0.207    -0.260
##    -0.378    -0.447
##    -0.378    -0.521
##    -0.378    -0.532
##    -0.378    -0.505
##     0.294     0.454
##     0.294     0.441
##     0.294     0.440
##     0.294     0.401
##     0.000     0.000
##     0.000     0.000
##     0.000     0.000
##     0.000     0.000
##
## Variances:
##                     Estimate  Std.Err   z-value  P(>|z|)  ci.lower  ci.upper
##     .confuW1S1        0.436    0.050     8.710    0.000     0.338     0.534
##     .confuW1S2        0.404    0.051     7.906    0.000     0.304     0.505
##     .confuW1P1        0.549    0.075     7.368    0.000     0.403     0.696
##     .confuW1P2        0.320    0.043     7.435    0.000     0.235     0.404
##     .confuW2S1        0.361    0.047     7.678    0.000     0.269     0.453
##     .confuW2S2        0.390    0.053     7.300    0.000     0.285     0.495
##     .confuW2P1        0.334    0.056     5.961    0.000     0.224     0.444
##     .confuW2P2        0.328    0.046     7.214    0.000     0.239     0.418
##     .confuW3S1        0.404    0.055     7.409    0.000     0.297     0.511
##     .confuW3S2        0.445    0.058     7.646    0.000     0.331     0.559
##     .confuW3P1        0.304    0.054     5.583    0.000     0.197     0.411
##     .confuW3P2        0.327    0.049     6.636    0.000     0.230     0.423
##     .confuW4S1        0.381    0.056     6.851    0.000     0.272     0.490
##     .confuW4S2        0.394    0.080     4.935    0.000     0.237     0.550
##     .confuW4P1        0.360    0.069     5.188    0.000     0.224     0.496
##     .confuW4P2        0.418    0.069     6.085    0.000     0.284     0.553
##     .confu1          -0.068    0.028    -2.434    0.015    -0.123    -0.013
##     .confu2          -0.018    0.021    -0.835    0.403    -0.059     0.024
##     .confu3          -0.005    0.024    -0.186    0.852    -0.052     0.043
##     .confu4          -0.023    0.036    -0.642    0.521    -0.093     0.047
##      interc           0.235    0.048     4.846    0.000     0.140     0.330
##      slope            0.000    0.000     2.098    0.036     0.000     0.001
##     Std.lv   Std.all
##     0.436     0.723
##     0.404     0.670
##     0.549     0.768
##     0.320     0.760
##     0.361     0.651
##     0.390     0.629
##     0.334     0.635
##     0.328     0.738
##     0.404     0.667
##     0.445     0.649
```

203

```
##      0.304      0.602
##      0.327      0.728
##      0.381      0.655
##      0.394      0.622
##      0.360      0.643
##      0.418      0.776
##     -0.407     -0.407
##     -0.091     -0.091
##     -0.022     -0.022
##     -0.114     -0.114
##      1.000      1.000
##      1.000      1.000
```

```r
semPaths(lgmConfu, what = "col", whatLabels = "est", intercepts = T)
```
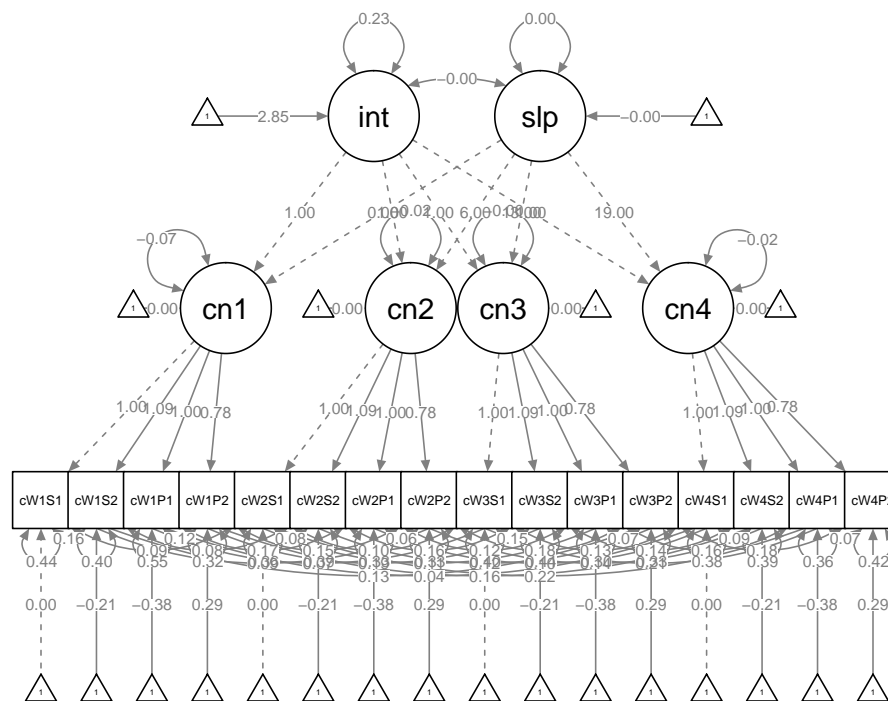

LGM Coherence

```r
lgmCoher <- '

# factor at each time point with same loading
coher1 =~ coherW1S1        + a * coherW1S2 +
          peer * coherW1P1 + aa * coherW1P2

coher2 =~ coherW2S1        + a * coherW2S2 +
          peer * coherW2P1 + aa * coherW2P2
```

```
coher3 =~ coherW3S1        + a * coherW3S2 +
           peer * coherW3P1 + aa * coherW3P2

coher4 =~ coherW4S1        + a * coherW4S2 +
           peer * coherW4P1 + aa * coherW4P2

# second coher factor for intercept and slope
interc =~ 1*coher1 + 1*coher2 + 1*coher3 + 1*coher4
slope =~ 0*coher1 + 6*coher2 + 13*coher3 + 19*coher4
interc ~~ slope
interc ~ 1
slope ~ 1

# fix zero intercepts
coherW1S1 ~ 0*1
coherW2S1 ~ 0*1
coherW3S1 ~ 0*1
coherW4S1 ~ 0*1

# fix equal intercepts
coherW1S2 ~ b*1
coherW2S2 ~ b*1
coherW3S2 ~ b*1
coherW4S2 ~ b*1

coherW1P1 ~ c*1
coherW2P1 ~ c*1
coherW3P1 ~ c*1
coherW4P1 ~ c*1

coherW1P2 ~ d*1
coherW2P2 ~ d*1
coherW3P2 ~ d*1
coherW4P2 ~ d*1

# error covariance - similar parcels across waves
coherW1S1 ~~ coherW2S1 + coherW3S1 + coherW4S1
coherW2S1 ~~ coherW3S1 + coherW4S1
coherW3S1 ~~ coherW4S1

coherW1S2 ~~ coherW2S2 + coherW3S2 + coherW4S2
coherW2S2 ~~ coherW3S2 + coherW4S2
coherW3S2 ~~ coherW4S2

coherW1P1 ~~ coherW2P1 + coherW3P1 + coherW4P1
coherW2P1 ~~ coherW3P1 + coherW4P1
coherW3P1 ~~ coherW4P1

coherW1P2 ~~ coherW2P2 + coherW3P2 + coherW4P2
coherW2P2 ~~ coherW3P2 + coherW4P2
coherW3P2 ~~ coherW4P2

# error covariance - same method at one wave
```

```
coherW1S1 ~~ coherW1S2
coherW1P1 ~~ coherW1P2
coherW2S1 ~~ coherW2S2
coherW2P1 ~~ coherW2P2
coherW3S1 ~~ coherW3S2
coherW3P1 ~~ coherW3P2
coherW4S1 ~~ coherW4S2
coherW4P1 ~~ coherW4P2
'
lgmCoher <- sem(lgmCoher, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lgmCoher, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 189 iterations
##
##    Estimator                                         ML
##    Optimization method                           NLMINB
##    Number of free parameters                         81
##    Number of equality constraints                    18
##
##    Number of observations                           259
##    Number of missing patterns                        55
##
## Model Test User Model:
##
##    Test statistic                               192.352
##    Degrees of freedom                                89
##    P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##    Test statistic                              1489.355
##    Degrees of freedom                               120
##    P-value                                        0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                    0.925
##    Tucker-Lewis Index (TLI)                       0.898
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)              -1727.529
##    Loglikelihood unrestricted model (H1)      -1631.353
##
##    Akaike (AIC)                                3581.058
##    Bayesian (BIC)                              3805.138
##    Sample-size adjusted Bayesian (BIC)         3605.405
##
## Root Mean Square Error of Approximation:
##
```

```
##   RMSEA                                        0.067
##   90 Percent confidence interval - lower       0.054
##   90 Percent confidence interval - upper       0.080
##   P-value RMSEA <= 0.05                         0.017
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                         0.134
##
## Parameter Estimates:
##
##   Standard errors                           Standard
##   Information                               Observed
##   Observed information based on              Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   coher1 =~
##     chrW1S1           1.000                                    1.000    1.000
##     chrW1S2    (a)    0.914    0.174    5.247    0.000    0.573    1.255
##     chrW1P1 (peer)    1.822    0.431    4.225    0.000    0.977    2.666
##     chrW1P2   (aa)    1.965    0.495    3.972    0.000    0.996    2.935
##   coher2 =~
##     chrW2S1           1.000                                    1.000    1.000
##     chrW2S2    (a)    0.914    0.174    5.247    0.000    0.573    1.255
##     chrW2P1 (peer)    1.822    0.431    4.225    0.000    0.977    2.666
##     chrW2P2   (aa)    1.965    0.495    3.972    0.000    0.996    2.935
##   coher3 =~
##     chrW3S1           1.000                                    1.000    1.000
##     chrW3S2    (a)    0.914    0.174    5.247    0.000    0.573    1.255
##     chrW3P1 (peer)    1.822    0.431    4.225    0.000    0.977    2.666
##     chrW3P2   (aa)    1.965    0.495    3.972    0.000    0.996    2.935
##   coher4 =~
##     chrW4S1           1.000                                    1.000    1.000
##     chrW4S2    (a)    0.914    0.174    5.247    0.000    0.573    1.255
##     chrW4P1 (peer)    1.822    0.431    4.225    0.000    0.977    2.666
##     chrW4P2   (aa)    1.965    0.495    3.972    0.000    0.996    2.935
##   interc =~
##     coher1            1.000                                    1.000    1.000
##     coher2            1.000                                    1.000    1.000
##     coher3            1.000                                    1.000    1.000
##     coher4            1.000                                    1.000    1.000
##   slope =~
##     coher1            0.000                                    0.000    0.000
##     coher2            6.000                                    6.000    6.000
##     coher3           13.000                                   13.000   13.000
##     coher4           19.000                                   19.000   19.000
##    Std.lv  Std.all
##
##    0.222    0.330
##    0.203    0.365
##    0.405    0.581
##    0.436    0.682
##
```

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```
##    0.221    0.329
##    0.202    0.354
##    0.403    0.637
##    0.434    0.693
##
##    0.238    0.325
##    0.217    0.379
##    0.433    0.684
##    0.467    0.752
##
##    0.222    0.342
##    0.202    0.354
##    0.404    0.641
##    0.435    0.707
##
##    1.080    1.080
##    1.085    1.085
##    1.009    1.009
##    1.082    1.082
##
##    0.000    0.000
##    0.201    0.201
##    0.406    0.406
##    0.636    0.636
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    interc ~~
##     slope          -0.000    0.000   -0.279    0.780   -0.001    0.001
##   .coherW1S1 ~~
##     .coherW2S1      0.190    0.035    5.495    0.000    0.122    0.257
##     .coherW3S1      0.160    0.036    4.388    0.000    0.089    0.231
##     .coherW4S1      0.147    0.034    4.333    0.000    0.080    0.213
##   .coherW2S1 ~~
##     .coherW3S1      0.205    0.039    5.226    0.000    0.128    0.281
##     .coherW4S1      0.170    0.036    4.709    0.000    0.099    0.241
##   .coherW3S1 ~~
##     .coherW4S1      0.191    0.041    4.706    0.000    0.111    0.270
##   .coherW1S2 ~~
##     .coherW2S2      0.145    0.025    5.830    0.000    0.096    0.194
##     .coherW3S2      0.140    0.024    5.736    0.000    0.092    0.188
##     .coherW4S2      0.126    0.026    4.894    0.000    0.076    0.177
##   .coherW2S2 ~~
##     .coherW3S2      0.140    0.027    5.279    0.000    0.088    0.192
##     .coherW4S2      0.139    0.027    5.201    0.000    0.087    0.192
##   .coherW3S2 ~~
##     .coherW4S2      0.151    0.029    5.165    0.000    0.094    0.208
##   .coherW1P1 ~~
##     .coherW2P1      0.068    0.024    2.820    0.005    0.021    0.115
##     .coherW3P1      0.044    0.026    1.697    0.090   -0.007    0.095
##     .coherW4P1      0.086    0.027    3.228    0.001    0.034    0.139
##   .coherW2P1 ~~
##     .coherW3P1      0.056    0.022    2.570    0.010    0.013    0.099
##     .coherW4P1      0.074    0.023    3.220    0.001    0.029    0.120
```

```
##   .coherW3P1 ~~
##     .coherW4P1          0.069    0.025    2.771    0.006    0.020    0.118
##   .coherW1P2 ~~
##     .coherW2P2          0.008    0.024    0.316    0.752   -0.039    0.054
##     .coherW3P2          0.025    0.024    1.012    0.311   -0.023    0.072
##     .coherW4P2          0.030    0.027    1.123    0.261   -0.023    0.083
##   .coherW2P2 ~~
##     .coherW3P2          0.017    0.024    0.718    0.473   -0.030    0.064
##     .coherW4P2          0.003    0.028    0.108    0.914   -0.051    0.057
##   .coherW3P2 ~~
##     .coherW4P2          0.018    0.030    0.606    0.545   -0.040    0.076
##   .coherW1S1 ~~
##     .coherW1S2          0.053    0.019    2.848    0.004    0.017    0.090
##   .coherW1P1 ~~
##     .coherW1P2          0.153    0.042    3.636    0.000    0.071    0.236
##   .coherW2S1 ~~
##     .coherW2S2          0.064    0.020    3.220    0.001    0.025    0.103
##   .coherW2P1 ~~
##     .coherW2P2          0.135    0.045    3.029    0.002    0.048    0.222
##   .coherW3S1 ~~
##     .coherW3S2          0.078    0.022    3.556    0.000    0.035    0.121
##   .coherW3P1 ~~
##     .coherW3P2          0.095    0.042    2.292    0.022    0.014    0.177
##   .coherW4S1 ~~
##     .coherW4S2          0.076    0.023    3.266    0.001    0.031    0.122
##   .coherW4P1 ~~
##     .coherW4P2          0.109    0.050    2.170    0.030    0.011    0.207
##    Std.lv  Std.all
##
##   -0.076   -0.076
##
##    0.190    0.470
##    0.160    0.365
##    0.147    0.379
##
##    0.205    0.467
##    0.170    0.440
##
##    0.191    0.454
##
##    0.145    0.524
##    0.140    0.508
##    0.126    0.456
##
##    0.140    0.495
##    0.139    0.488
##
##    0.151    0.532
##
##    0.068    0.246
##    0.044    0.168
##    0.086    0.315
##
##    0.056    0.248
```

```
##     0.074    0.316
##
##     0.069    0.310
##
##     0.008    0.035
##     0.025    0.128
##     0.030    0.149
##
##     0.017    0.093
##     0.003    0.015
##
##     0.018    0.100
##
##     0.053    0.161
##
##     0.153    0.578
##
##     0.064    0.188
##
##     0.135    0.612
##
##     0.078    0.213
##
##     0.095    0.505
##
##     0.076    0.235
##
##     0.109    0.518
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      interc           3.493    0.036   96.775    0.000    3.422    3.564
##      slope           -0.000    0.001   -0.294    0.768   -0.003    0.002
##    .coherW1S1         0.000                               0.000    0.000
##    .coherW2S1         0.000                               0.000    0.000
##    .coherW3S1         0.000                               0.000    0.000
##    .coherW4S1         0.000                               0.000    0.000
##    .coherW1S2  (b)    0.767    0.609    1.259    0.208   -0.427    1.961
##    .coherW2S2  (b)    0.767    0.609    1.259    0.208   -0.427    1.961
##    .coherW3S2  (b)    0.767    0.609    1.259    0.208   -0.427    1.961
##    .coherW4S2  (b)    0.767    0.609    1.259    0.208   -0.427    1.961
##    .coherW1P1  (c)   -2.366    1.505   -1.571    0.116   -5.316    0.585
##    .coherW2P1  (c)   -2.366    1.505   -1.571    0.116   -5.316    0.585
##    .coherW3P1  (c)   -2.366    1.505   -1.571    0.116   -5.316    0.585
##    .coherW4P1  (c)   -2.366    1.505   -1.571    0.116   -5.316    0.585
##    .coherW1P2  (d)   -2.889    1.727   -1.673    0.094   -6.273    0.495
##    .coherW2P2  (d)   -2.889    1.727   -1.673    0.094   -6.273    0.495
##    .coherW3P2  (d)   -2.889    1.727   -1.673    0.094   -6.273    0.495
##    .coherW4P2  (d)   -2.889    1.727   -1.673    0.094   -6.273    0.495
##    .coher1            0.000                               0.000    0.000
##    .coher2            0.000                               0.000    0.000
##    .coher3            0.000                               0.000    0.000
##    .coher4            0.000                               0.000    0.000
##    Std.lv  Std.all
```

```
##      14.569    14.569
##      -0.047    -0.047
##       0.000     0.000
##       0.000     0.000
##       0.000     0.000
##       0.000     0.000
##       0.767     1.377
##       0.767     1.345
##       0.767     1.338
##       0.767     1.342
##      -2.366    -3.396
##      -2.366    -3.741
##      -2.366    -3.740
##      -2.366    -3.757
##      -2.889    -4.515
##      -2.889    -4.607
##      -2.889    -4.652
##      -2.889    -4.691
##       0.000     0.000
##       0.000     0.000
##       0.000     0.000
##       0.000     0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .coherW1S1        0.404    0.038   10.546    0.000    0.329    0.479
##     .coherW1S2        0.269    0.026   10.226    0.000    0.217    0.320
##     .coherW1P1        0.322    0.055    5.801    0.000    0.213    0.430
##     .coherW1P2        0.219    0.046    4.717    0.000    0.128    0.310
##     .coherW2S1        0.403    0.042    9.699    0.000    0.322    0.485
##     .coherW2S2        0.284    0.030    9.440    0.000    0.225    0.343
##     .coherW2P1        0.238    0.044    5.461    0.000    0.152    0.323
##     .coherW2P2        0.205    0.057    3.574    0.000    0.092    0.317
##     .coherW3S1        0.476    0.051    9.400    0.000    0.377    0.576
##     .coherW3S2        0.281    0.030    9.338    0.000    0.222    0.340
##     .coherW3P1        0.213    0.047    4.555    0.000    0.121    0.305
##     .coherW3P2        0.168    0.049    3.441    0.001    0.072    0.263
##     .coherW4S1        0.370    0.044    8.412    0.000    0.284    0.456
##     .coherW4S2        0.286    0.034    8.439    0.000    0.219    0.352
##     .coherW4P1        0.234    0.052    4.461    0.000    0.131    0.336
##     .coherW4P2        0.190    0.062    3.065    0.002    0.068    0.311
##     .coher1          -0.008    0.011   -0.746    0.456   -0.030    0.013
##     .coher2          -0.009    0.010   -0.870    0.384   -0.029    0.011
##     .coher3          -0.007    0.009   -0.773    0.440   -0.024    0.010
##     .coher4          -0.023    0.015   -1.498    0.134   -0.053    0.007
##      interc           0.057    0.025    2.283    0.022    0.008    0.107
##      slope            0.000    0.000    1.198    0.231   -0.000    0.000
##     Std.lv  Std.all
##      0.404    0.891
##      0.269    0.867
##      0.322    0.663
##      0.219    0.535
##      0.403    0.892
##      0.284    0.874
```

```
##     0.238     0.595
##     0.205     0.520
##     0.476     0.894
##     0.281     0.856
##     0.213     0.532
##     0.168     0.435
##     0.370     0.883
##     0.286     0.874
##     0.234     0.589
##     0.190     0.500
##    -0.166    -0.166
##    -0.184    -0.184
##    -0.121    -0.121
##    -0.470    -0.470
##     1.000     1.000
##     1.000     1.000
```

```r
semPaths(lgmCoher, what = "col", whatLabels = "est", intercepts = T)
```
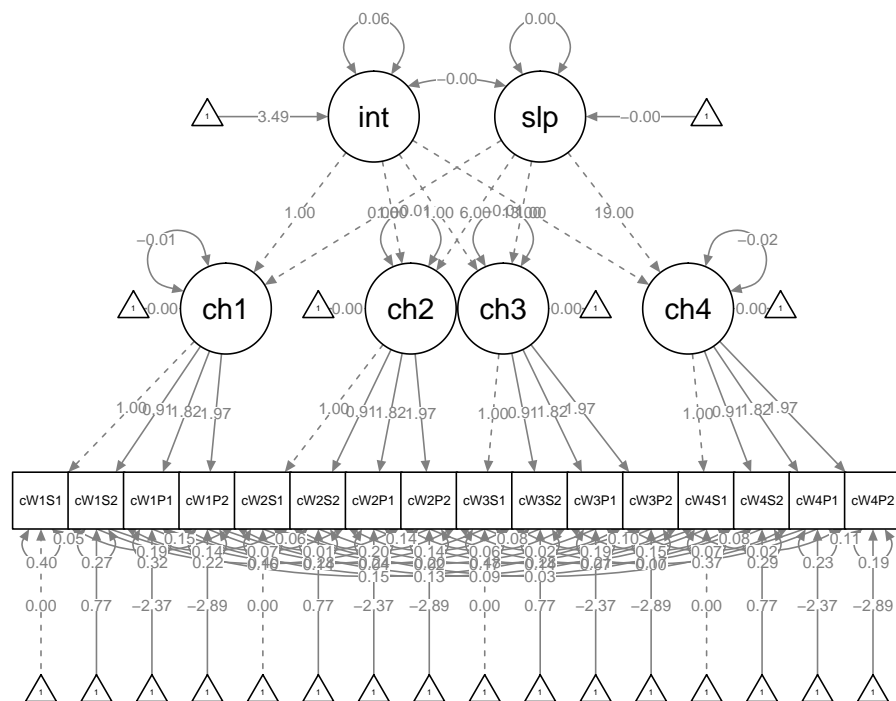

Latent stability model

LSM Agreeableness

with aspects as parcels

```r
lsmAgree <- '

# factor at each time point with same loading
agree1 =~ compaW1S        + a * politW1S +
          peer * compaW1P + aa * politW1P

agree2 =~ compaW2S        + a * politW2S +
          peer * compaW2P + aa * politW2P

agree3 =~ compaW3S        + a * politW3S +
          peer * compaW3P + aa * politW3P

agree4 =~ compaW4S        + a * politW4S +
          peer * compaW4P + aa * politW4P

# structural paths between time points
agree4 ~ agree3
agree3 ~ agree2
agree2 ~ agree1

# error covariance - similar aspects across waves and informants
compaW1S ~~ compaW2S + compaW3S + compaW4S +
            compaW1P + compaW2P + compaW3P + compaW4P
compaW2S ~~ compaW3S + compaW4S +
            compaW1P + compaW2P + compaW3P + compaW4P
compaW3S ~~ compaW4S +
            compaW1P + compaW2P + compaW3P + compaW4P
compaW4S ~~ compaW1P + compaW2P + compaW3P + compaW4P

politW1S ~~ politW2S + politW3S + politW4S +
            politW1P + politW2P + politW3P + politW4P
politW2S ~~ politW3S + politW4S +
            politW1P + politW2P + politW3P + politW4P
politW3S ~~ politW4S +
            politW1P + politW2P + politW3P + politW4P
politW4S ~~ politW1P + politW2P + politW3P + politW4P

compaW1P ~~ compaW2P + compaW3P + compaW4P
compaW2P ~~ compaW3P + compaW4P
compaW3P ~~ compaW4P

politW1P ~~ politW2P + politW3P + politW4P
politW2P ~~ politW3P + politW4P
politW3P ~~ politW4P
'
lsmAgree <- sem(lsmAgree, data = data, missing = "ML")

## Warning in lav_object_post_check(object): lavaan WARNING: the covariance matrix of the residuals of
##                variables (theta) is not positive definite;
##                use lavInspect(fit, "theta") to investigate.
summary(lsmAgree, fit.measures = T, standardized = T, ci = T)

## lavaan 0.6-7 ended normally after 237 iterations
```

```
##
##    Estimator                                         ML
##    Optimization method                           NLMINB
##    Number of free parameters                        107
##    Number of equality constraints                     9
##
##    Number of observations                           259
##    Number of missing patterns                        51
##
## Model Test User Model:
##
##    Test statistic                               126.710
##    Degrees of freedom                                54
##    P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##    Test statistic                              2012.112
##    Degrees of freedom                               120
##    P-value                                        0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                    0.962
##    Tucker-Lewis Index (TLI)                       0.915
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)              -1072.147
##    Loglikelihood unrestricted model (H1)      -1008.792
##
##    Akaike (AIC)                                2340.294
##    Bayesian (BIC)                              2688.863
##    Sample-size adjusted Bayesian (BIC)         2378.168
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                          0.072
##    90 Percent confidence interval - lower         0.056
##    90 Percent confidence interval - upper         0.088
##    P-value RMSEA <= 0.05                           0.014
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                           0.102
##
## Parameter Estimates:
##
##    Standard errors                             Standard
##    Information                                 Observed
##    Observed information based on                Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
```

```
##   agree1 =~
##     compW1S              1.000                                   1.000    1.000
##     poltW1S    (a)       1.322       NA                             NA       NA
##     compW1P (peer)       3.363    1.062    3.167    0.002        1.282    5.445
##     poltW1P   (aa)       2.567       NA                             NA       NA
##   agree2 =~
##     compW2S              1.000                                   1.000    1.000
##     poltW2S    (a)       1.322       NA                             NA       NA
##     compW2P (peer)       3.363    1.062    3.167    0.002        1.282    5.445
##     poltW2P   (aa)       2.567       NA                             NA       NA
##   agree3 =~
##     compW3S              1.000                                   1.000    1.000
##     poltW3S    (a)       1.322       NA                             NA       NA
##     compW3P (peer)       3.363    1.062    3.167    0.002        1.282    5.445
##     poltW3P   (aa)       2.567       NA                             NA       NA
##   agree4 =~
##     compW4S              1.000                                   1.000    1.000
##     poltW4S    (a)       1.322       NA                             NA       NA
##     compW4P (peer)       3.363    1.062    3.167    0.002        1.282    5.445
##     poltW4P   (aa)       2.567       NA                             NA       NA
##    Std.lv  Std.all
##
##    0.153    0.327
##    0.202    0.378
##    0.514    0.887
##    0.392    0.666
##
##    0.156    0.323
##    0.206    0.382
##    0.523    0.911
##    0.399    0.706
##
##    0.158    0.330
##    0.208    0.378
##    0.530    0.954
##    0.405    0.642
##
##    0.169    0.349
##    0.223    0.416
##    0.568    0.981
##    0.433    0.694
##
## Regressions:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   agree4 ~
##     agree3            1.014    0.069   14.791    0.000    0.880    1.148
##   agree3 ~
##     agree2            0.943    0.074   12.657    0.000    0.797    1.089
##   agree2 ~
##     agree1            0.844    0.077   10.995    0.000    0.693    0.994
##    Std.lv  Std.all
##
##    0.947    0.947
##
```

```
##    0.930    0.930
##
##    0.829    0.829
##
## Covariances:
##                 Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .compaW1S ~~
##     .compaW2S      0.123       NA                        NA       NA
##     .compaW3S      0.114       NA                        NA       NA
##     .compaW4S      0.116       NA                        NA       NA
##     .compaW1P      0.006       NA                        NA       NA
##     .compaW2P      0.036       NA                        NA       NA
##     .compaW3P      0.035       NA                        NA       NA
##     .compaW4P      0.008       NA                        NA       NA
##   .compaW2S ~~
##     .compaW3S      0.154       NA                        NA       NA
##     .compaW4S      0.155       NA                        NA       NA
##   .compaW1P ~~
##     .compaW2S      0.028       NA                        NA       NA
##   .compaW2S ~~
##     .compaW2P     -0.006       NA                        NA       NA
##     .compaW3P      0.017       NA                        NA       NA
##     .compaW4P      0.010       NA                        NA       NA
##   .compaW3S ~~
##     .compaW4S      0.171       NA                        NA       NA
##   .compaW1P ~~
##     .compaW3S      0.014       NA                        NA       NA
##   .compaW2P ~~
##     .compaW3S     -0.007       NA                        NA       NA
##   .compaW3S ~~
##     .compaW3P     -0.008       NA                        NA       NA
##     .compaW4P     -0.023       NA                        NA       NA
##   .compaW1P ~~
##     .compaW4S      0.002       NA                        NA       NA
##   .compaW2P ~~
##     .compaW4S     -0.010       NA                        NA       NA
##   .compaW3P ~~
##     .compaW4S      0.003       NA                        NA       NA
##   .compaW4S ~~
##     .compaW4P     -0.026       NA                        NA       NA
##   .politW1S ~~
##     .politW2S      0.183       NA                        NA       NA
##     .politW3S      0.167       NA                        NA       NA
##     .politW4S      0.165       NA                        NA       NA
##     .politW1P      0.085       NA                        NA       NA
##     .politW2P      0.058       NA                        NA       NA
##     .politW3P      0.061       NA                        NA       NA
##     .politW4P      0.065       NA                        NA       NA
##   .politW2S ~~
##     .politW3S      0.199       NA                        NA       NA
##     .politW4S      0.183       NA                        NA       NA
##   .politW1P ~~
##     .politW2S      0.089       NA                        NA       NA
##   .politW2S ~~
```

```
##    .politW2P           0.057       NA                      NA       NA
##    .politW3P           0.033       NA                      NA       NA
##    .politW4P           0.053       NA                      NA       NA
## .politW3S ~~
##    .politW4S           0.209       NA                      NA       NA
## .politW1P ~~
##    .politW3S           0.095       NA                      NA       NA
## .politW2P ~~
##    .politW3S           0.063       NA                      NA       NA
## .politW3S ~~
##    .politW3P           0.040       NA                      NA       NA
##    .politW4P           0.057       NA                      NA       NA
## .politW1P ~~
##    .politW4S           0.091       NA                      NA       NA
## .politW2P ~~
##    .politW4S           0.073       NA                      NA       NA
## .politW3P ~~
##    .politW4S           0.056       NA                      NA       NA
## .politW4S ~~
##    .politW4P           0.069       NA                      NA       NA
## .compaW1P ~~
##    .compaW2P          -0.016       NA                      NA       NA
##    .compaW3P           0.015       NA                      NA       NA
##    .compaW4P           0.000       NA                      NA       NA
## .compaW2P ~~
##    .compaW3P          -0.010       NA                      NA       NA
##    .compaW4P          -0.007       NA                      NA       NA
## .compaW3P ~~
##    .compaW4P          -0.014       NA                      NA       NA
## .politW1P ~~
##    .politW2P           0.114       NA                      NA       NA
##    .politW3P           0.110       NA                      NA       NA
##    .politW4P           0.130       NA                      NA       NA
## .politW2P ~~
##    .politW3P           0.123       NA                      NA       NA
##    .politW4P           0.124       NA                      NA       NA
## .politW3P ~~
##    .politW4P           0.167       NA                      NA       NA
##    Std.lv  Std.all
##
##    0.123    0.608
##    0.114    0.573
##    0.116    0.580
##    0.006    0.049
##    0.036    0.344
##    0.035    0.479
##    0.008    0.159
##
##    0.154    0.750
##    0.155    0.751
##
##    0.028    0.230
##
##   -0.006   -0.055
```

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```
##     0.017    0.228
##     0.010    0.200
##
##     0.171    0.835
##
##     0.014    0.115
##
##    -0.007   -0.063
##
##    -0.008   -0.107
##    -0.023   -0.451
##
##     0.002    0.019
##
##    -0.010   -0.091
##
##     0.003    0.041
##
##    -0.026   -0.515
##
##     0.183    0.742
##     0.167    0.663
##     0.165    0.684
##     0.085    0.389
##     0.058    0.293
##     0.061    0.254
##     0.065    0.293
##
##     0.199    0.786
##     0.183    0.754
##
##     0.089    0.405
##
##     0.057    0.287
##     0.033    0.139
##     0.053    0.235
##
##     0.209    0.841
##
##     0.095    0.422
##
##     0.063    0.306
##
##     0.040    0.162
##     0.057    0.246
##
##     0.091    0.426
##
##     0.073    0.373
##
##     0.056    0.236
##
##     0.069    0.315
##
```

```
##    -0.016    -0.247
##     0.015     0.332
##     0.000     0.002
##
##    -0.010    -0.263
##    -0.007    -0.262
##
##    -0.014    -0.761
##
##     0.114     0.644
##     0.110     0.517
##     0.130     0.657
##
##     0.123     0.636
##     0.124     0.688
##
##     0.167     0.769
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .compaW1S         4.146    0.029  142.461    0.000    4.089    4.203
##     .politW1S         3.698    0.033  111.332    0.000    3.633    3.763
##     .compaW1P         3.932    0.045   87.826    0.000    3.845    4.020
##     .politW1P         3.826    0.044   86.323    0.000    3.739    3.913
##     .compaW2S         4.126    0.032  127.505    0.000    4.063    4.190
##     .politW2S         3.734    0.036  105.155    0.000    3.664    3.803
##     .compaW2P         3.978    0.045   88.720    0.000    3.890    4.066
##     .politW2P         3.802    0.044   87.285    0.000    3.716    3.887
##     .compaW3S         4.133    0.033  127.091    0.000    4.069    4.197
##     .politW3S         3.733    0.037  101.172    0.000    3.661    3.806
##     .compaW3P         3.974    0.043   91.389    0.000    3.889    4.059
##     .politW3P         3.796    0.050   75.211    0.000    3.697    3.895
##     .compaW4S         4.196    0.034  122.690    0.000    4.129    4.263
##     .politW4S         3.770    0.037  101.218    0.000    3.697    3.843
##     .compaW4P         3.891    0.048   80.829    0.000    3.796    3.985
##     .politW4P         3.707    0.051   72.835    0.000    3.607    3.807
##      agree1           0.000                               0.000    0.000
##     .agree2           0.000                               0.000    0.000
##     .agree3           0.000                               0.000    0.000
##     .agree4           0.000                               0.000    0.000
##     Std.lv   Std.all
##      4.146     8.861
##      3.698     6.923
##      3.932     6.787
##      3.826     6.490
##      4.126     8.577
##      3.734     6.934
##      3.978     6.926
##      3.802     6.719
##      4.133     8.646
##      3.733     6.778
##      3.974     7.154
##      3.796     6.022
##      4.196     8.669
```

```
##     3.770    7.031
##     3.891    6.723
##     3.707    5.932
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .compaW1S           0.196       NA                         NA       NA
##    .politW1S           0.245       NA                         NA       NA
##    .compaW1P           0.071       NA                         NA       NA
##    .politW1P           0.194       NA                         NA       NA
##    .compaW2S           0.207       NA                         NA       NA
##    .politW2S           0.248       NA                         NA       NA
##    .compaW2P           0.056       NA                         NA       NA
##    .politW2P           0.161       NA                         NA       NA
##    .compaW3S           0.204       NA                         NA       NA
##    .politW3S           0.260       NA                         NA       NA
##    .compaW3P           0.028       NA                         NA       NA
##    .politW3P           0.234       NA                         NA       NA
##    .compaW4S           0.206       NA                         NA       NA
##    .politW4S           0.238       NA                         NA       NA
##    .compaW4P           0.013       NA                         NA       NA
##    .politW4P           0.203       NA                         NA       NA
##     agree1             0.023       NA                         NA       NA
##    .agree2             0.008       NA                         NA       NA
##    .agree3             0.003       NA                         NA       NA
##    .agree4             0.003       NA                         NA       NA
##    Std.lv  Std.all
##     0.196    0.893
##     0.245    0.857
##     0.071    0.213
##     0.194    0.557
##     0.207    0.896
##     0.248    0.854
##     0.056    0.171
##     0.161    0.502
##     0.204    0.891
##     0.260    0.857
##     0.028    0.089
##     0.234    0.588
##     0.206    0.878
##     0.238    0.827
##     0.013    0.037
##     0.203    0.519
##     1.000    1.000
##     0.312    0.312
##     0.135    0.135
##     0.104    0.104
```

```r
semPaths(lsmAgree, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
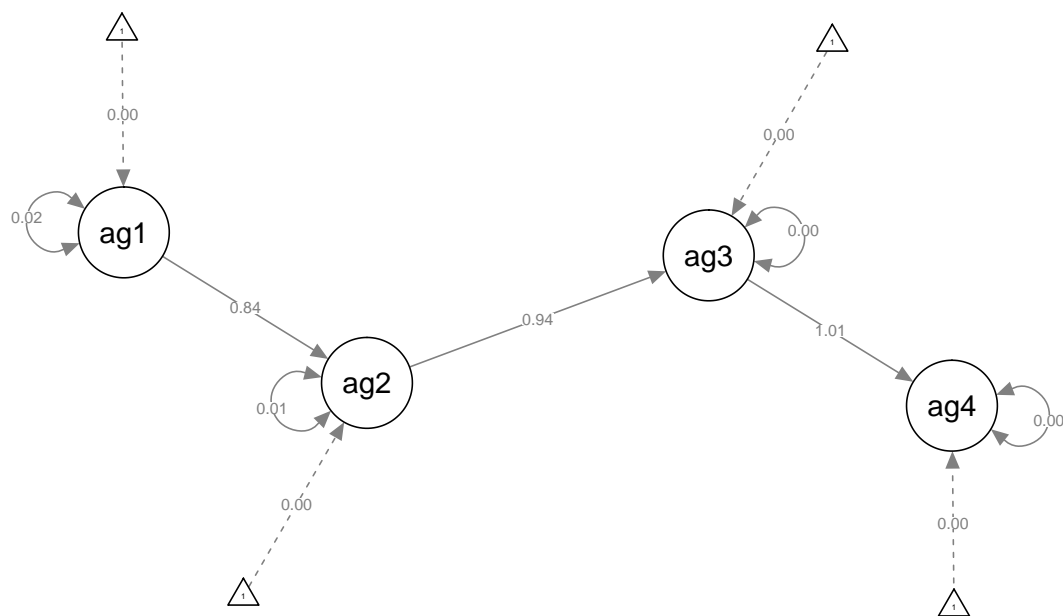
with random parcels

```
lsmAgree <- '

# factor at each time point with same loading
agree1 =~ agreeW1S1       + a * agreeW1S2 +
         peer * agreeW1P1 + aa * agreeW1P2

agree2 =~ agreeW2S1       + a * agreeW2S2 +
         peer * agreeW2P1 + aa * agreeW2P2

agree3 =~ agreeW3S1       + a * agreeW3S2 +
         peer * agreeW3P1 + aa * agreeW3P2

agree4 =~ agreeW4S1       + a * agreeW4S2 +
         peer * agreeW4P1 + aa * agreeW4P2

# structural paths between time points
agree4 ~ agree3
agree3 ~ agree2
agree2 ~ agree1

# error covariance - similar parcels across waves
agreeW1S1 ~~ agreeW2S1 + agreeW3S1 + agreeW4S1
agreeW2S1 ~~ agreeW3S1 + agreeW4S1
```

```
agreeW3S1 ~~ agreeW4S1

agreeW1S2 ~~ agreeW2S2 + agreeW3S2 + agreeW4S2
agreeW2S2 ~~ agreeW3S2 + agreeW4S2
agreeW3S2 ~~ agreeW4S2

agreeW1P1 ~~ agreeW2P1 + agreeW3P1 + agreeW4P1
agreeW2P1 ~~ agreeW3P1 + agreeW4P1
agreeW3P1 ~~ agreeW4P1

agreeW1P2 ~~ agreeW2P2 + agreeW3P2 + agreeW4P2
agreeW2P2 ~~ agreeW3P2 + agreeW4P2
agreeW3P2 ~~ agreeW4P2

# error covariance - same method at one wave
agreeW1S1 ~~ agreeW1S2
agreeW1P1 ~~ agreeW1P2
agreeW2S1 ~~ agreeW2S2
agreeW2P1 ~~ agreeW2P2
agreeW3S1 ~~ agreeW3S2
agreeW3P1 ~~ agreeW3P2
agreeW4S1 ~~ agreeW4S2
agreeW4P1 ~~ agreeW4P2
'
lsmAgree <- sem(lsmAgree, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!
```

```
summary(lsmAgree, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 did NOT end normally after 323 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA
```

```
## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on               Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   agree1 =~
##     agrW1S1            1.000                                1.000    1.000
##     agrW1S2    (a)     1.115       NA                          NA       NA
##     agrW1P1 (peer)     1.074       NA                          NA       NA
##     agrW1P2   (aa)     0.985       NA                          NA       NA
##   agree2 =~
##     agrW2S1            1.000                                1.000    1.000
##     agrW2S2    (a)     1.115       NA                          NA       NA
##     agrW2P1 (peer)     1.074       NA                          NA       NA
##     agrW2P2   (aa)     0.985       NA                          NA       NA
##   agree3 =~
##     agrW3S1            1.000                                1.000    1.000
##     agrW3S2    (a)     1.115       NA                          NA       NA
##     agrW3P1 (peer)     1.074       NA                          NA       NA
##     agrW3P2   (aa)     0.985       NA                          NA       NA
##   agree4 =~
##     agrW4S1            1.000                                1.000    1.000
##     agrW4S2    (a)     1.115       NA                          NA       NA
##     agrW4P1 (peer)     1.074       NA                          NA       NA
##     agrW4P2   (aa)     0.985       NA                          NA       NA
##    Std.lv  Std.all
##
##    2.022    0.944
##    2.255    0.948
##    2.172    0.927
##    1.991    0.948
##
##    3.116    0.996
##    3.475    0.992
##    3.347    0.983
##    3.068    0.981
##
##    3.116    0.988
##    3.476    0.989
##    3.347    0.981
##    3.069    0.981
##
##    3.152    0.990
##    3.516    0.984
##    3.386    0.979
##    3.104    0.979
##
## Regressions:
```

```
##                       Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   agree4 ~
##     agree3             1.011       NA                          NA       NA
##   agree3 ~
##     agree2             1.000       NA                          NA       NA
##   agree2 ~
##     agree1             1.522       NA                          NA       NA
##    Std.lv   Std.all
##
##    0.999    0.999
##
##    1.000    1.000
##
##    0.988    0.988
##
## Covariances:
##                       Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .agreeW1S1 ~~
##     .agreeW2S1         0.036       NA                          NA       NA
##     .agreeW3S1         0.049       NA                          NA       NA
##     .agreeW4S1        -0.013       NA                          NA       NA
##   .agreeW2S1 ~~
##     .agreeW3S1         0.030       NA                          NA       NA
##     .agreeW4S1         0.022       NA                          NA       NA
##   .agreeW3S1 ~~
##     .agreeW4S1         0.029       NA                          NA       NA
##   .agreeW1S2 ~~
##     .agreeW2S2         0.121       NA                          NA       NA
##     .agreeW3S2         0.111       NA                          NA       NA
##     .agreeW4S2         0.151       NA                          NA       NA
##   .agreeW2S2 ~~
##     .agreeW3S2         0.079       NA                          NA       NA
##     .agreeW4S2         0.056       NA                          NA       NA
##   .agreeW3S2 ~~
##     .agreeW4S2         0.121       NA                          NA       NA
##   .agreeW1P1 ~~
##     .agreeW2P1        -0.036       NA                          NA       NA
##     .agreeW3P1         0.051       NA                          NA       NA
##     .agreeW4P1         0.090       NA                          NA       NA
##   .agreeW2P1 ~~
##     .agreeW3P1         0.041       NA                          NA       NA
##     .agreeW4P1         0.154       NA                          NA       NA
##   .agreeW3P1 ~~
##     .agreeW4P1         0.222       NA                          NA       NA
##   .agreeW1P2 ~~
##     .agreeW2P2         0.291       NA                          NA       NA
##     .agreeW3P2         0.291       NA                          NA       NA
##     .agreeW4P2         0.314       NA                          NA       NA
##   .agreeW2P2 ~~
##     .agreeW3P2         0.370       NA                          NA       NA
##     .agreeW4P2         0.403       NA                          NA       NA
##   .agreeW3P2 ~~
##     .agreeW4P2         0.403       NA                          NA       NA
##   .agreeW1S1 ~~
```

```
##    .agreeW1S2          0.417       NA                    NA       NA
## .agreeW1P1 ~~
##    .agreeW1P2          0.415       NA                    NA       NA
## .agreeW2S1 ~~
##    .agreeW2S2          0.036       NA                    NA       NA
## .agreeW2P1 ~~
##    .agreeW2P2          0.000       NA                    NA       NA
## .agreeW3S1 ~~
##    .agreeW3S2          0.148       NA                    NA       NA
## .agreeW3P1 ~~
##    .agreeW3P2          0.000       NA                    NA       NA
## .agreeW4S1 ~~
##    .agreeW4S2          0.211       NA                    NA       NA
## .agreeW4P1 ~~
##    .agreeW4P2         -0.005       NA                    NA       NA
##   Std.lv  Std.all
##
##    0.036    0.193
##    0.049    0.143
##   -0.013   -0.041
##
##    0.030    0.230
##    0.022    0.180
##
##    0.029    0.135
##
##    0.121    0.361
##    0.111    0.286
##    0.151    0.311
##
##    0.079    0.344
##    0.056    0.197
##
##    0.121    0.366
##
##   -0.036   -0.065
##    0.051    0.088
##    0.090    0.146
##
##    0.041    0.098
##    0.154    0.349
##
##    0.222    0.481
##
##    0.291    0.711
##    0.291    0.711
##    0.314    0.715
##
##    0.370    1.000
##    0.403    1.012
##
##    0.403    1.012
##
##    0.417    0.778
```

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```
##
##     0.415     0.703
##
##     0.036     0.302
##
##     0.000     0.000
##
##     0.148     0.598
##
##     0.000     0.000
##
##     0.211     0.729
##
##    -0.005    -0.011
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .agreeW1S1        1.551       NA                         NA       NA
##     .agreeW1S2        1.463       NA                         NA       NA
##     .agreeW1P1        1.029       NA                         NA       NA
##     .agreeW1P2        1.197       NA                         NA       NA
##     .agreeW2S1        0.348       NA                         NA       NA
##     .agreeW2S2        0.072       NA                         NA       NA
##     .agreeW2P1        0.079       NA                         NA       NA
##     .agreeW2P2        0.139       NA                         NA       NA
##     .agreeW3S1        0.419       NA                         NA       NA
##     .agreeW3S2        0.096       NA                         NA       NA
##     .agreeW3P1        0.089       NA                         NA       NA
##     .agreeW3P2        0.139       NA                         NA       NA
##     .agreeW4S1        0.381       NA                         NA       NA
##     .agreeW4S2        0.074       NA                         NA       NA
##     .agreeW4P1       -0.052       NA                         NA       NA
##     .agreeW4P2        0.103       NA                         NA       NA
##      agree1           0.000                              0.000    0.000
##     .agree2           0.000                              0.000    0.000
##     .agree3           0.000                              0.000    0.000
##     .agree4           0.000                              0.000    0.000
##     Std.lv   Std.all
##     1.551     0.724
##     1.463     0.615
##     1.029     0.439
##     1.197     0.570
##     0.348     0.111
##     0.072     0.021
##     0.079     0.023
##     0.139     0.045
##     0.419     0.133
##     0.096     0.027
##     0.089     0.026
##     0.139     0.044
##     0.381     0.120
##     0.074     0.021
##    -0.052    -0.015
##     0.103     0.033
```

```
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .agreeW1S1       0.503       NA                         NA       NA
##     .agreeW1S2       0.570       NA                         NA       NA
##     .agreeW1P1       0.775       NA                         NA       NA
##     .agreeW1P2       0.451       NA                         NA       NA
##     .agreeW2S1       0.071       NA                         NA       NA
##     .agreeW2S2       0.198       NA                         NA       NA
##     .agreeW2P1       0.398       NA                         NA       NA
##     .agreeW2P2       0.370       NA                         NA       NA
##     .agreeW3S1       0.232       NA                         NA       NA
##     .agreeW3S2       0.266       NA                         NA       NA
##     .agreeW3P1       0.435       NA                         NA       NA
##     .agreeW3P2       0.370       NA                         NA       NA
##     .agreeW4S1       0.205       NA                         NA       NA
##     .agreeW4S2       0.410       NA                         NA       NA
##     .agreeW4P1       0.489       NA                         NA       NA
##     .agreeW4P2       0.427       NA                         NA       NA
##      agree1          4.087       NA                         NA       NA
##     .agree2          0.237       NA                         NA       NA
##     .agree3          0.000       NA                         NA       NA
##     .agree4          0.015       NA                         NA       NA
##    Std.lv  Std.all
##     0.503    0.110
##     0.570    0.101
##     0.775    0.141
##     0.451    0.102
##     0.071    0.007
##     0.198    0.016
##     0.398    0.034
##     0.370    0.038
##     0.232    0.023
##     0.266    0.022
##     0.435    0.037
##     0.370    0.038
##     0.205    0.020
##     0.410    0.032
##     0.489    0.041
##     0.427    0.042
##     1.000    1.000
##     0.024    0.024
##     0.000    0.000
##     0.002    0.002
semPaths(lsmAgree, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
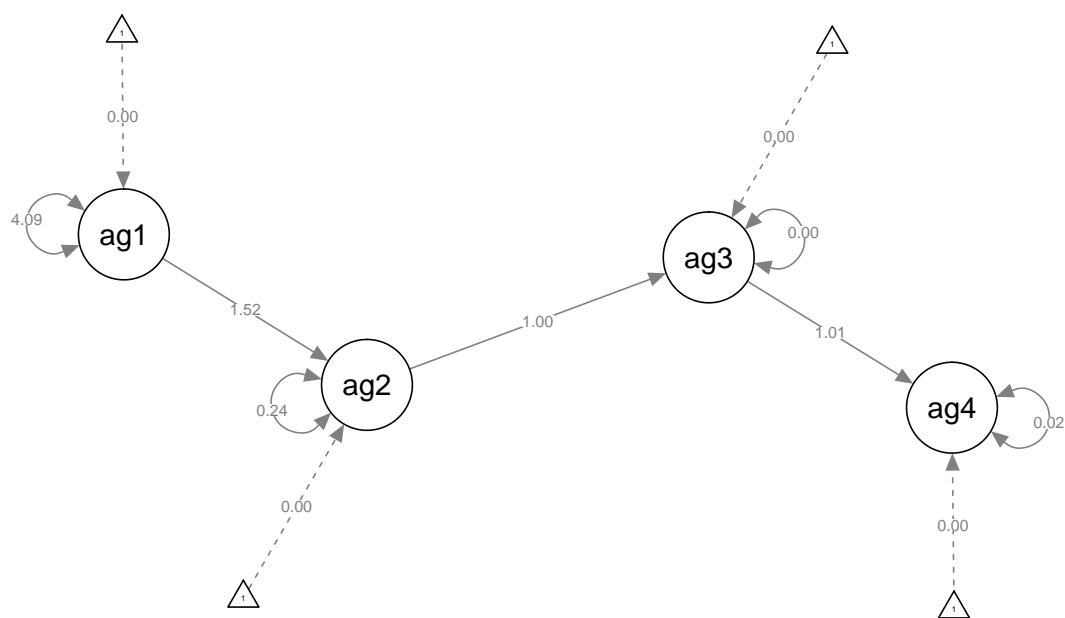
LSM Conscientiousness

with aspects as parcels

```
lsmConsci <- '

# factor at each time point with same loading
consci1 =~ indusW1S        + a * orderW1S +
         peer * indusW1P + aa * orderW1P

consci2 =~ indusW2S        + a * orderW2S +
         peer * indusW2P + aa * orderW2P

consci3 =~ indusW3S        + a * orderW3S +
         peer * indusW3P + aa * orderW3P

consci4 =~ indusW4S        + a * orderW4S +
         peer * indusW4P + aa * orderW4P

# structural paths between time points
consci4 ~ consci3
consci3 ~ consci2
consci2 ~ consci1

# error covariance - similar aspects across waves and informants
indusW1S ~~ indusW2S + indusW3S + indusW4S +
```

```
                indusW1P + indusW2P + indusW3P + indusW4P
indusW2S ~~ indusW3S + indusW4S +
                indusW1P + indusW2P + indusW3P + indusW4P
indusW3S ~~ indusW4S +
                indusW1P + indusW2P + indusW3P + indusW4P
indusW4S ~~ indusW1P + indusW2P + indusW3P + indusW4P


orderW1S ~~ orderW2S + orderW3S + orderW4S +
                orderW1P + orderW2P + orderW3P + orderW4P
orderW2S ~~ orderW3S + orderW4S +
                orderW1P + orderW2P + orderW3P + orderW4P
orderW3S ~~ orderW4S +
                orderW1P + orderW2P + orderW3P + orderW4P
orderW4S ~~ orderW1P + orderW2P + orderW3P + orderW4P


indusW1P ~~ indusW2P + indusW3P + indusW4P
indusW2P ~~ indusW3P + indusW4P
indusW3P ~~ indusW4P


orderW1P ~~ orderW2P + orderW3P + orderW4P
orderW2P ~~ orderW3P + orderW4P
orderW3P ~~ orderW4P
'
lsmConsci <- sem(lsmConsci, data = data, missing = "ML")
summary(lsmConsci, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 221 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                        107
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                               111.782
##   Degrees of freedom                                54
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2107.030
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.971
##   Tucker-Lewis Index (TLI)                       0.935
##
## Loglikelihood and Information Criteria:
```

```
##
##   Loglikelihood user model (H0)              -1335.933
##   Loglikelihood unrestricted model (H1)      -1280.042
##
##   Akaike (AIC)                                2867.866
##   Bayesian (BIC)                              3216.436
##   Sample-size adjusted Bayesian (BIC)         2905.740
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.064
##   90 Percent confidence interval - lower         0.047
##   90 Percent confidence interval - upper         0.081
##   P-value RMSEA <= 0.05                          0.081
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.079
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
##
## Latent Variables:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   consci1 =~
##     indsW1S          1.000                                1.000    1.000
##     ordrW1S    (a)   0.820       NA                          NA       NA
##     indsW1P (peer)   2.433    0.866    2.810    0.005    0.736    4.130
##     ordrW1P   (aa)   1.695       NA                          NA       NA
##   consci2 =~
##     indsW2S          1.000                                1.000    1.000
##     ordrW2S    (a)   0.820       NA                          NA       NA
##     indsW2P (peer)   2.433    0.866    2.810    0.005    0.736    4.130
##     ordrW2P   (aa)   1.695       NA                          NA       NA
##   consci3 =~
##     indsW3S          1.000                                1.000    1.000
##     ordrW3S    (a)   0.820       NA                          NA       NA
##     indsW3P (peer)   2.433    0.866    2.810    0.005    0.736    4.130
##     ordrW3P   (aa)   1.695       NA                          NA       NA
##   consci4 =~
##     indsW4S          1.000                                1.000    1.000
##     ordrW4S    (a)   0.820       NA                          NA       NA
##     indsW4P (peer)   2.433    0.866    2.810    0.005    0.736    4.130
##     ordrW4P   (aa)   1.695       NA                          NA       NA
##    Std.lv  Std.all
##
##    0.219    0.364
##    0.179    0.289
##    0.532    0.861
##    0.371    0.584
##
```

```
##    0.207    0.334
##    0.170    0.304
##    0.504    0.828
##    0.351    0.611
##
##    0.191    0.326
##    0.157    0.269
##    0.465    0.739
##    0.324    0.514
##
##    0.188    0.318
##    0.154    0.247
##    0.457    0.790
##    0.318    0.528
##
## Regressions:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   consci4 ~
##     consci3           0.871    0.105    8.324    0.000     0.666     1.076
##   consci3 ~
##     consci2           0.870    0.088    9.838    0.000     0.697     1.043
##   consci2 ~
##     consci1           0.759    0.081    9.354    0.000     0.600     0.918
##    Std.lv  Std.all
##
##    0.886    0.886
##
##    0.943    0.943
##
##    0.801    0.801
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   .indusW1S ~~
##     .indusW2S         0.250       NA                         NA        NA
##     .indusW3S         0.213       NA                         NA        NA
##     .indusW4S         0.219       NA                         NA        NA
##     .indusW1P         0.005       NA                         NA        NA
##     .indusW2P         0.032       NA                         NA        NA
##     .indusW3P         0.041       NA                         NA        NA
##     .indusW4P         0.019       NA                         NA        NA
##   .indusW2S ~~
##     .indusW3S         0.257       NA                         NA        NA
##     .indusW4S         0.268       NA                         NA        NA
##   .indusW1P ~~
##     .indusW2S         0.010       NA                         NA        NA
##   .indusW2S ~~
##     .indusW2P         0.035       NA                         NA        NA
##     .indusW3P         0.058       NA                         NA        NA
##     .indusW4P         0.036       NA                         NA        NA
##   .indusW3S ~~
##     .indusW4S         0.263       NA                         NA        NA
##   .indusW1P ~~
##     .indusW3S         0.006       NA                         NA        NA
```

```
##   .indusW2P ~~
##     .indusW3S          0.030       NA                         NA       NA
##   .indusW3S ~~
##     .indusW3P          0.016       NA                         NA       NA
##     .indusW4P          0.002       NA                         NA       NA
##   .indusW1P ~~
##     .indusW4S          0.036       NA                         NA       NA
##   .indusW2P ~~
##     .indusW4S          0.053       NA                         NA       NA
##   .indusW3P ~~
##     .indusW4S          0.026       NA                         NA       NA
##   .indusW4S ~~
##     .indusW4P          0.011       NA                         NA       NA
##   .orderW1S ~~
##     .orderW2S          0.237       NA                         NA       NA
##     .orderW3S          0.252       NA                         NA       NA
##     .orderW4S          0.237       NA                         NA       NA
##     .orderW1P          0.077       NA                         NA       NA
##     .orderW2P          0.111       NA                         NA       NA
##     .orderW3P          0.082       NA                         NA       NA
##     .orderW4P          0.095       NA                         NA       NA
##   .orderW2S ~~
##     .orderW3S          0.243       NA                         NA       NA
##     .orderW4S          0.238       NA                         NA       NA
##   .orderW1P ~~
##     .orderW2S          0.094       NA                         NA       NA
##   .orderW2S ~~
##     .orderW2P          0.100       NA                         NA       NA
##     .orderW3P          0.084       NA                         NA       NA
##     .orderW4P          0.085       NA                         NA       NA
##   .orderW3S ~~
##     .orderW4S          0.274       NA                         NA       NA
##   .orderW1P ~~
##     .orderW3S          0.088       NA                         NA       NA
##   .orderW2P ~~
##     .orderW3S          0.123       NA                         NA       NA
##   .orderW3S ~~
##     .orderW3P          0.074       NA                         NA       NA
##     .orderW4P          0.095       NA                         NA       NA
##   .orderW1P ~~
##     .orderW4S          0.101       NA                         NA       NA
##   .orderW2P ~~
##     .orderW4S          0.134       NA                         NA       NA
##   .orderW3P ~~
##     .orderW4S          0.107       NA                         NA       NA
##   .orderW4S ~~
##     .orderW4P          0.117       NA                         NA       NA
##   .indusW1P ~~
##     .indusW2P          0.040       NA                         NA       NA
##     .indusW3P          0.080       NA                         NA       NA
##     .indusW4P          0.076       NA                         NA       NA
##   .indusW2P ~~
##     .indusW3P          0.089       NA                         NA       NA
##     .indusW4P          0.086       NA                         NA       NA
```

```
##   .indusW3P ~~
##      .indusW4P          0.120      NA                      NA      NA
##   .orderW1P ~~
##      .orderW2P          0.168      NA                      NA      NA
##      .orderW3P          0.215      NA                      NA      NA
##      .orderW4P          0.164      NA                      NA      NA
##   .orderW2P ~~
##      .orderW3P          0.190      NA                      NA      NA
##      .orderW4P          0.165      NA                      NA      NA
##   .orderW3P ~~
##      .orderW4P          0.217      NA                      NA      NA
##    Std.lv  Std.all
##
##     0.250    0.765
##     0.213    0.686
##     0.219    0.699
##     0.005    0.029
##     0.032    0.165
##     0.041    0.174
##     0.019    0.095
##
##     0.257    0.792
##     0.268    0.820
##
##     0.010    0.052
##
##     0.035    0.177
##     0.058    0.233
##     0.036    0.174
##
##     0.263    0.846
##
##     0.006    0.033
##
##     0.030    0.161
##
##     0.016    0.068
##     0.002    0.009
##
##     0.036    0.203
##
##     0.053    0.280
##
##     0.026    0.111
##
##     0.011    0.055
##
##     0.237    0.750
##     0.252    0.757
##     0.237    0.661
##     0.077    0.253
##     0.111    0.412
##     0.082    0.257
##     0.095    0.314
```

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```
##
##      0.243    0.816
##      0.238    0.741
##
##      0.094    0.343
##
##      0.100    0.413
##      0.084    0.291
##      0.085    0.313
##
##      0.274    0.806
##
##      0.088    0.306
##
##      0.123    0.481
##
##      0.074    0.244
##      0.095    0.330
##
##      0.101    0.326
##
##      0.134    0.485
##
##      0.107    0.326
##
##      0.117    0.377
##
##      0.040    0.373
##      0.080    0.599
##      0.076    0.684
##
##      0.089    0.619
##      0.086    0.713
##
##      0.120    0.798
##
##      0.168    0.718
##      0.215    0.774
##      0.164    0.621
##
##      0.190    0.773
##      0.165    0.707
##
##      0.217    0.782
##
## Intercepts:
##                     Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##      .indusW1S         3.183    0.037   85.257    0.000     3.110     3.256
##      .orderW1S         3.563    0.039   92.392    0.000     3.487     3.638
##      .indusW1P         3.699    0.048   76.985    0.000     3.604     3.793
##      .orderW1P         3.375    0.049   69.411    0.000     3.280     3.470
##      .indusW2S         3.137    0.041   77.123    0.000     3.057     3.217
##      .orderW2S         3.638    0.037   98.978    0.000     3.566     3.710
##      .indusW2P         3.668    0.047   77.303    0.000     3.575     3.761
```

```
##     .orderW2P          3.460    0.044   79.166    0.000    3.375    3.546
##     .indusW3S          3.173    0.039   80.732    0.000    3.096    3.250
##     .orderW3S          3.625    0.038   94.240    0.000    3.550    3.700
##     .indusW3P          3.692    0.049   74.637    0.000    3.596    3.789
##     .orderW3P          3.379    0.049   68.376    0.000    3.282    3.476
##     .indusW4S          3.186    0.041   77.790    0.000    3.106    3.266
##     .orderW4S          3.650    0.044   82.402    0.000    3.563    3.737
##     .indusW4P          3.610    0.048   74.892    0.000    3.516    3.705
##     .orderW4P          3.314    0.051   64.476    0.000    3.213    3.415
##      consci1           0.000                               0.000    0.000
##     .consci2           0.000                               0.000    0.000
##     .consci3           0.000                               0.000    0.000
##     .consci4           0.000                               0.000    0.000
##    Std.lv  Std.all
##     3.183    5.301
##     3.563    5.745
##     3.699    5.985
##     3.375    5.320
##     3.137    5.062
##     3.638    6.519
##     3.668    6.028
##     3.460    6.021
##     3.173    5.407
##     3.625    6.221
##     3.692    5.872
##     3.379    5.363
##     3.186    5.395
##     3.650    5.847
##     3.610    6.243
##     3.314    5.489
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .indusW1S          0.313      NA                               NA       NA
##     .orderW1S          0.352      NA                               NA       NA
##     .indusW1P          0.099      NA                               NA       NA
##     .orderW1P          0.265      NA                               NA       NA
##     .indusW2S          0.341      NA                               NA       NA
##     .orderW2S          0.283      NA                               NA       NA
##     .indusW2P          0.117      NA                               NA       NA
##     .orderW2P          0.207      NA                               NA       NA
##     .indusW3S          0.308      NA                               NA       NA
##     .orderW3S          0.315      NA                               NA       NA
##     .indusW3P          0.179      NA                               NA       NA
##     .orderW3P          0.292      NA                               NA       NA
##     .indusW4S          0.314      NA                               NA       NA
##     .orderW4S          0.366      NA                               NA       NA
##     .indusW4P          0.126      NA                               NA       NA
##     .orderW4P          0.263      NA                               NA       NA
##      consci1           0.048      NA                               NA       NA
```

```
##    .consci2          0.015      NA                    NA      NA
##    .consci3          0.004      NA                    NA      NA
##    .consci4          0.008      NA                    NA      NA
##    Std.lv  Std.all
##    0.313   0.867
##    0.352   0.916
##    0.099   0.259
##    0.265   0.659
##    0.341   0.888
##    0.283   0.907
##    0.117   0.315
##    0.207   0.627
##    0.308   0.894
##    0.315   0.928
##    0.179   0.454
##    0.292   0.736
##    0.314   0.899
##    0.366   0.939
##    0.126   0.376
##    0.263   0.722
##    1.000   1.000
##    0.358   0.358
##    0.111   0.111
##    0.214   0.214
```

```r
semPaths(lsmConsci, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
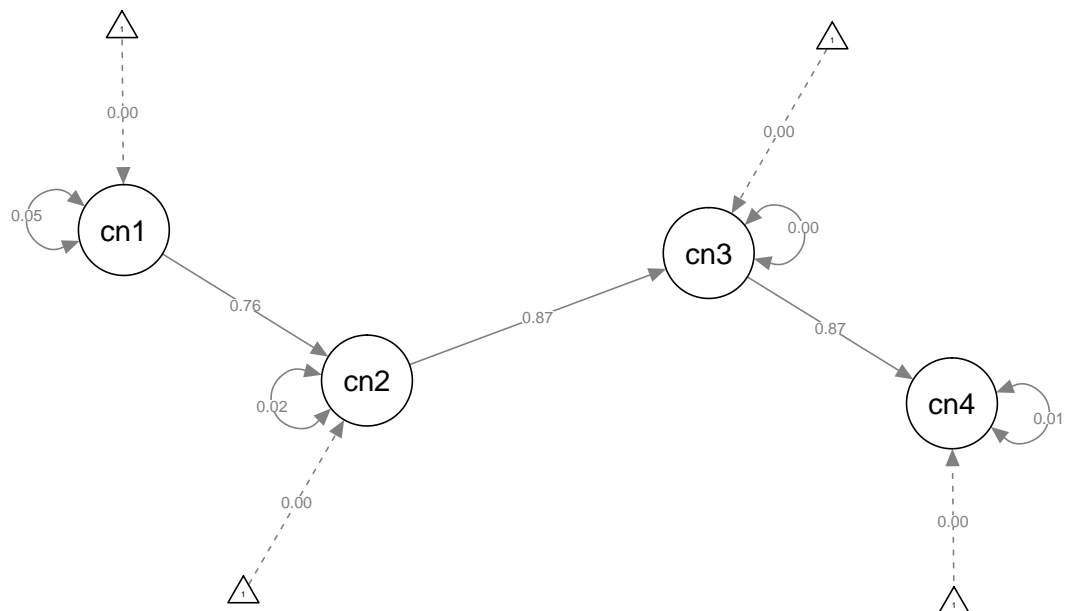
with random parcels

```
lsmconsci <- '

# factor at each time point with same loading
consci1 =~ consciW1S1        + a * consciW1S2 +
           peer * consciW1P1 + aa * consciW1P2

consci2 =~ consciW2S1        + a * consciW2S2 +
           peer * consciW2P1 + aa * consciW2P2

consci3 =~ consciW3S1        + a * consciW3S2 +
           peer * consciW3P1 + aa * consciW3P2

consci4 =~ consciW4S1        + a * consciW4S2 +
           peer * consciW4P1 + aa * consciW4P2

# structural paths between time points
consci4 ~ consci3
consci3 ~ consci2
consci2 ~ consci1

# error covariance - similar parcels across waves
consciW1S1 ~~ consciW2S1 + consciW3S1 + consciW4S1
consciW2S1 ~~ consciW3S1 + consciW4S1
consciW3S1 ~~ consciW4S1

consciW1S2 ~~ consciW2S2 + consciW3S2 + consciW4S2
consciW2S2 ~~ consciW3S2 + consciW4S2
consciW3S2 ~~ consciW4S2

consciW1P1 ~~ consciW2P1 + consciW3P1 + consciW4P1
consciW2P1 ~~ consciW3P1 + consciW4P1
consciW3P1 ~~ consciW4P1

consciW1P2 ~~ consciW2P2 + consciW3P2 + consciW4P2
consciW2P2 ~~ consciW3P2 + consciW4P2
consciW3P2 ~~ consciW4P2

# error covariance - same method at one wave
consciW1S1 ~~ consciW1S2
consciW1P1 ~~ consciW1P2
consciW2S1 ~~ consciW2S2
consciW2P1 ~~ consciW2P2
consciW3S1 ~~ consciW3S2
consciW3P1 ~~ consciW3P2
consciW4S1 ~~ consciW4S2
consciW4P1 ~~ consciW4P2
'
lsmconsci <- sem(lsmconsci, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
```

```
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!
```

```r
summary(lsmconsci, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 did NOT end normally after 427 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA

## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge

##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   consci1 =~
##     cnsW1S1            1.000                                1.000    1.000
##     cnsW1S2    (a)     1.038       NA                          NA       NA
##     cnsW1P1 (peer)     1.154       NA                          NA       NA
##     cnsW1P2   (aa)     0.976       NA                          NA       NA
##   consci2 =~
##     cnsW2S1            1.000                                1.000    1.000
##     cnsW2S2    (a)     1.038       NA                          NA       NA
##     cnsW2P1 (peer)     1.154       NA                          NA       NA
##     cnsW2P2   (aa)     0.976       NA                          NA       NA
##   consci3 =~
##     cnsW3S1            1.000                                1.000    1.000
##     cnsW3S2    (a)     1.038       NA                          NA       NA
##     cnsW3P1 (peer)     1.154       NA                          NA       NA
##     cnsW3P2   (aa)     0.976       NA                          NA       NA
##   consci4 =~
##     cnsW4S1            1.000                                1.000    1.000
##     cnsW4S2    (a)     1.038       NA                          NA       NA
##     cnsW4P1 (peer)     1.154       NA                          NA       NA
##     cnsW4P2   (aa)     0.976       NA                          NA       NA
```

```
##    Std.lv  Std.all
##
##    1.891   0.959
##    1.964   0.970
##    2.182   0.929
##    1.846   0.968
##
##    2.814   0.985
##    2.922   0.993
##    3.248   0.982
##    2.746   0.976
##
##    2.813   0.989
##    2.921   0.988
##    3.246   0.985
##    2.745   0.976
##
##    2.839   0.982
##    2.948   0.987
##    3.277   0.979
##    2.771   0.976
##
## Regressions:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   consci4 ~
##     consci3          1.009       NA                        NA       NA
##   consci3 ~
##     consci2          0.999       NA                        NA       NA
##   consci2 ~
##     consci1          1.491       NA                        NA       NA
##    Std.lv  Std.all
##
##    1.000   1.000
##
##    1.000   1.000
##
##    1.002   1.002
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .consciW1S1 ~~
##     .consciW2S1      0.117       NA                        NA       NA
##     .consciW3S1      0.081       NA                        NA       NA
##     .consciW4S1      0.172       NA                        NA       NA
##   .consciW2S1 ~~
##     .consciW3S1      0.084       NA                        NA       NA
##     .consciW4S1      0.199       NA                        NA       NA
##   .consciW3S1 ~~
##     .consciW4S1      0.156       NA                        NA       NA
##   .consciW1S2 ~~
##     .consciW2S2      0.030       NA                        NA       NA
##     .consciW3S2      0.092       NA                        NA       NA
##     .consciW4S2      0.085       NA                        NA       NA
##   .consciW2S2 ~~
```

```
##    .consciW3S2        0.074      NA                          NA      NA
##    .consciW4S2        0.073      NA                          NA      NA
## .consciW3S2 ~~
##    .consciW4S2        0.160      NA                          NA      NA
## .consciW1P1 ~~
##    .consciW2P1        0.022      NA                          NA      NA
##    .consciW3P1        0.216      NA                          NA      NA
##    .consciW4P1        0.134      NA                          NA      NA
## .consciW2P1 ~~
##    .consciW3P1        0.030      NA                          NA      NA
##    .consciW4P1        0.297      NA                          NA      NA
## .consciW3P1 ~~
##    .consciW4P1        0.070      NA                          NA      NA
## .consciW1P2 ~~
##    .consciW2P2        0.223      NA                          NA      NA
##    .consciW3P2        0.223      NA                          NA      NA
##    .consciW4P2        0.225      NA                          NA      NA
## .consciW2P2 ~~
##    .consciW3P2        0.373      NA                          NA      NA
##    .consciW4P2        0.377      NA                          NA      NA
## .consciW3P2 ~~
##    .consciW4P2        0.377      NA                          NA      NA
## .consciW1S1 ~~
##    .consciW1S2        0.159      NA                          NA      NA
## .consciW1P1 ~~
##    .consciW1P2        0.212      NA                          NA      NA
## .consciW2S1 ~~
##    .consciW2S2        0.048      NA                          NA      NA
## .consciW2P1 ~~
##    .consciW2P2       -0.000      NA                          NA      NA
## .consciW3S1 ~~
##    .consciW3S2        0.051      NA                          NA      NA
## .consciW3P1 ~~
##    .consciW3P2       -0.000      NA                          NA      NA
## .consciW4S1 ~~
##    .consciW4S2        0.010      NA                          NA      NA
## .consciW4P1 ~~
##    .consciW4P2        0.002      NA                          NA      NA
##    Std.lv  Std.all
##
##    0.117    0.430
##    0.081    0.342
##    0.172    0.560
##
##    0.084    0.403
##    0.199    0.738
##
##    0.156    0.663
##
##    0.030    0.186
##    0.092    0.414
##    0.085    0.358
##
##    0.074    0.486
```

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```
##     0.073    0.451
##
##     0.160    0.722
##
##     0.022    0.041
##     0.216    0.442
##     0.134    0.227
##
##     0.030    0.085
##     0.297    0.706
##
##     0.070    0.183
##
##     0.223    0.759
##     0.223    0.759
##     0.225    0.756
##
##     0.373    1.000
##     0.377    1.001
##
##     0.377    1.001
##
##     0.159    0.585
##
##     0.212    0.506
##
##     0.048    0.294
##
##    -0.000   -0.000
##
##     0.051    0.261
##
##    -0.000   -0.000
##
##     0.010    0.036
##
##     0.002    0.005
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .consciW1S1      1.187       NA                        NA       NA
##     .consciW1S2      1.307       NA                        NA       NA
##     .consciW1P1      1.163       NA                        NA       NA
##     .consciW1P2      1.232       NA                        NA       NA
##     .consciW2S1      0.163       NA                        NA       NA
##     .consciW2S2      0.214       NA                        NA       NA
##     .consciW2P1      0.104       NA                        NA       NA
##     .consciW2P2      0.245       NA                        NA       NA
##     .consciW3S1      0.177       NA                        NA       NA
##     .consciW3S2      0.214       NA                        NA       NA
##     .consciW3P1      0.244       NA                        NA       NA
##     .consciW3P2      0.247       NA                        NA       NA
##     .consciW4S1      0.162       NA                        NA       NA
##     .consciW4S2      0.188       NA                        NA       NA
```

```
##     .consciW4P1       -0.049     NA                        NA       NA
##     .consciW4P2        0.216     NA                        NA       NA
##      consci1           0.000                            0.000    0.000
##     .consci2           0.000                            0.000    0.000
##     .consci3           0.000                            0.000    0.000
##     .consci4           0.000                            0.000    0.000
##    Std.lv  Std.all
##    1.187    0.602
##    1.307    0.646
##    1.163    0.495
##    1.232    0.646
##    0.163    0.057
##    0.214    0.073
##    0.104    0.031
##    0.245    0.087
##    0.177    0.062
##    0.214    0.072
##    0.244    0.074
##    0.247    0.088
##    0.162    0.056
##    0.188    0.063
##   -0.049   -0.015
##    0.216    0.076
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .consciW1S1        0.309     NA                        NA       NA
##     .consciW1S2        0.239     NA                        NA       NA
##     .consciW1P1        0.755     NA                        NA       NA
##     .consciW1P2        0.232     NA                        NA       NA
##     .consciW2S1        0.239     NA                        NA       NA
##     .consciW2S2        0.112     NA                        NA       NA
##     .consciW2P1        0.385     NA                        NA       NA
##     .consciW2P2        0.374     NA                        NA       NA
##     .consciW3S1        0.182     NA                        NA       NA
##     .consciW3S2        0.207     NA                        NA       NA
##     .consciW3P1        0.315     NA                        NA       NA
##     .consciW3P2        0.373     NA                        NA       NA
##     .consciW4S1        0.305     NA                        NA       NA
##     .consciW4S2        0.236     NA                        NA       NA
##     .consciW4P1        0.462     NA                        NA       NA
##     .consciW4P2        0.381     NA                        NA       NA
##      consci1           3.576     NA                        NA       NA
##     .consci2          -0.027     NA                        NA       NA
##     .consci3          -0.000     NA                        NA       NA
##     .consci4           0.001     NA                        NA       NA
##    Std.lv  Std.all
##    0.309    0.079
##    0.239    0.058
##    0.755    0.137
```

```
##     0.232     0.064
##     0.239     0.029
##     0.112     0.013
##     0.385     0.035
##     0.374     0.047
##     0.182     0.023
##     0.207     0.024
##     0.315     0.029
##     0.373     0.047
##     0.305     0.036
##     0.236     0.026
##     0.462     0.041
##     0.381     0.047
##     1.000     1.000
##    -0.003    -0.003
##    -0.000    -0.000
##     0.000     0.000
```

```r
semPaths(lsmconsci, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
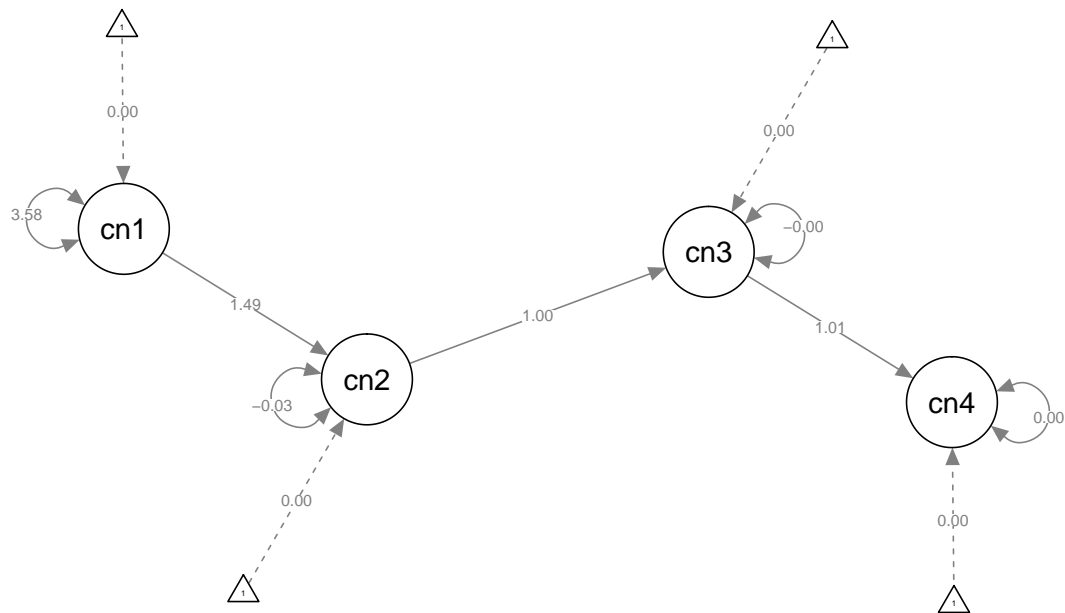

LSM Extraversion

with aspects as parcels

```r
lsmExtra <- '

# factor at each time point with same loading
```

```
extra1 =~ assertW1S        + a * enthuW1S +
          peer * assertW1P + aa * enthuW1P

extra2 =~ assertW2S        + a * enthuW2S +
          peer * assertW2P + aa * enthuW2P

extra3 =~ assertW3S        + a * enthuW3S +
          peer * assertW3P + aa * enthuW3P

extra4 =~ assertW4S        + a * enthuW4S +
          peer * assertW4P + aa * enthuW4P

# structural paths between time points
extra4 ~ extra3
extra3 ~ extra2
extra2 ~ extra1

# error covariance - similar aspects across waves and informants
assertW1S ~~ assertW2S + assertW3S + assertW4S +
             assertW1P + assertW2P + assertW3P + assertW4P
assertW2S ~~ assertW3S + assertW4S +
             assertW1P + assertW2P + assertW3P + assertW4P
assertW3S ~~ assertW4S +
             assertW1P + assertW2P + assertW3P + assertW4P
assertW4S ~~ assertW1P + assertW2P + assertW3P + assertW4P

enthuW1S ~~ enthuW2S + enthuW3S + enthuW4S +
            enthuW1P + enthuW2P + enthuW3P + enthuW4P
enthuW2S ~~ enthuW3S + enthuW4S +
            enthuW1P + enthuW2P + enthuW3P + enthuW4P
enthuW3S ~~ enthuW4S +
            enthuW1P + enthuW2P + enthuW3P + enthuW4P
enthuW4S ~~ enthuW1P + enthuW2P + enthuW3P + enthuW4P

assertW1P ~~ assertW2P + assertW3P + assertW4P
assertW2P ~~ assertW3P + assertW4P
assertW3P ~~ assertW4P

enthuW1P ~~ enthuW2P + enthuW3P + enthuW4P
enthuW2P ~~ enthuW3P + enthuW4P
enthuW3P ~~ enthuW4P
'
lsmExtra <- sem(lsmExtra, data = data, missing = "ML")
summary(lsmExtra, fit.measures = T, standardized = T, ci = T)

## lavaan 0.6-7 ended normally after 254 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                        107
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        51
```

```
##
## Model Test User Model:
##
##   Test statistic                                118.553
##   Degrees of freedom                                  54
##   P-value (Chi-square)                             0.000
##
## Model Test Baseline Model:
##
##   Test statistic                               2412.811
##   Degrees of freedom                                 120
##   P-value                                          0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                      0.972
##   Tucker-Lewis Index (TLI)                         0.937
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)                -1261.787
##   Loglikelihood unrestricted model (H1)        -1202.510
##
##   Akaike (AIC)                                  2719.573
##   Bayesian (BIC)                                3068.142
##   Sample-size adjusted Bayesian (BIC)           2757.447
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                            0.068
##   90 Percent confidence interval - lower           0.051
##   90 Percent confidence interval - upper           0.085
##   P-value RMSEA <= 0.05                            0.038
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                             0.176
##
## Parameter Estimates:
##
##   Standard errors                               Standard
##   Information                                   Observed
##   Observed information based on                  Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   extra1 =~
##     assrW1S              1.000                                   1.000    1.000
##     enthW1S    (a)       0.701   40.976    0.017    0.986  -79.610   81.013
##     assrW1P  (peer)     -0.907    0.242   -3.751    0.000   -1.381   -0.433
##     enthW1P   (aa)      -0.561   32.784   -0.017    0.986  -64.817   63.695
##   extra2 =~
##     assrW2S              1.000                                   1.000    1.000
##     enthW2S    (a)       0.701   40.976    0.017    0.986  -79.610   81.013
```

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```
##     assrW2P (peer)   -0.907    0.242  -3.751   0.000   -1.381   -0.433
##     enthW2P  (aa)    -0.561   32.784  -0.017   0.986  -64.817   63.695
##   extra3 =~
##     assrW3S           1.000                              1.000    1.000
##     enthW3S    (a)     0.701   40.976   0.017   0.986  -79.610   81.013
##     assrW3P (peer)   -0.907    0.242  -3.751   0.000   -1.381   -0.433
##     enthW3P  (aa)    -0.561   32.784  -0.017   0.986  -64.817   63.695
##   extra4 =~
##     assrW4S           1.000                              1.000    1.000
##     enthW4S    (a)     0.701   40.976   0.017   0.986  -79.610   81.013
##     assrW4P (peer)   -0.907    0.242  -3.751   0.000   -1.381   -0.433
##     enthW4P  (aa)    -0.561   32.784  -0.017   0.986  -64.817   63.695
##    Std.lv  Std.all
##
##    0.291    0.432
##    0.204    0.323
##   -0.264   -0.444
##   -0.163   -0.265
##
##    0.304    0.447
##    0.213    0.336
##   -0.276   -0.482
##   -0.171   -0.286
##
##    0.310    0.460
##    0.218    0.343
##   -0.282   -0.497
##   -0.174   -0.337
##
##    0.329    0.480
##    0.231    0.354
##   -0.298   -0.574
##   -0.185   -0.376
##
## Regressions:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   extra4 ~
##     extra3          0.978    0.101   9.645    0.000    0.779    1.176
##   extra3 ~
##     extra2          0.817    0.115   7.101    0.000    0.591    1.042
##   extra2 ~
##     extra1          0.811    0.112   7.210    0.000    0.590    1.031
##    Std.lv  Std.all
##
##    0.922    0.922
##
##    0.799    0.799
##
##    0.776    0.776
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##  .assertW1S ~~
##    .assertW2S       0.315    4.002   0.079    0.937   -7.529    8.158
```

```
##    .assertW3S          0.318   3.268   0.097   0.922   -6.086   6.723
##    .assertW4S          0.296   3.194   0.093   0.926   -5.965   6.557
##    .assertW1P          0.247   4.478   0.055   0.956   -8.529   9.024
##    .assertW2P          0.213   3.629   0.059   0.953   -6.900   7.327
##    .assertW3P          0.195   2.964   0.066   0.948   -5.614   6.003
##    .assertW4P          0.169   2.897   0.058   0.953   -5.509   5.847
## .assertW2S ~~
##    .assertW3S          0.325   4.403   0.074   0.941   -8.304   8.955
##    .assertW4S          0.315   4.304   0.073   0.942   -8.121   8.751
## .assertW1P ~~
##    .assertW2S          0.237   3.629   0.065   0.948   -6.877   7.350
## .assertW2S ~~
##    .assertW2P          0.238   4.890   0.049   0.961   -9.347   9.822
##    .assertW3P          0.209   3.993   0.052   0.958   -7.617   8.036
##    .assertW4P          0.173   3.904   0.044   0.965   -7.477   7.824
## .assertW3S ~~
##    .assertW4S          0.321   5.502   0.058   0.954  -10.463  11.104
## .assertW1P ~~
##    .assertW3S          0.201   2.964   0.068   0.946   -5.608   6.010
## .assertW2P ~~
##    .assertW3S          0.200   3.993   0.050   0.960   -7.627   8.026
## .assertW3S ~~
##    .assertW3P          0.201   5.105   0.039   0.969   -9.804  10.206
##    .assertW4P          0.173   4.990   0.035   0.972   -9.608   9.953
## .assertW1P ~~
##    .assertW4S          0.203   2.897   0.070   0.944   -5.475   5.882
## .assertW2P ~~
##    .assertW4S          0.208   3.904   0.053   0.958   -7.443   7.859
## .assertW3P ~~
##    .assertW4S          0.197   4.990   0.040   0.968   -9.583   9.977
## .assertW4S ~~
##    .assertW4P          0.205   5.738   0.036   0.972  -11.041  11.451
## .enthuW1S ~~
##    .enthuW2S           0.281   1.969   0.143   0.887   -3.579   4.141
##    .enthuW3S           0.257   1.608   0.160   0.873   -2.896   3.409
##    .enthuW4S           0.269   1.572   0.171   0.864   -2.813   3.350
##    .enthuW1P           0.188   1.944   0.097   0.923   -3.623   3.998
##    .enthuW2P           0.175   1.576   0.111   0.912   -2.913   3.264
##    .enthuW3P           0.130   1.287   0.101   0.920   -2.392   2.652
##    .enthuW4P           0.083   1.258   0.066   0.947   -2.382   2.549
## .enthuW2S ~~
##    .enthuW3S           0.298   2.167   0.137   0.891   -3.949   4.545
##    .enthuW4S           0.297   2.118   0.140   0.888   -3.854   4.449
## .enthuW1P ~~
##    .enthuW2S           0.172   1.576   0.109   0.913   -2.916   3.261
## .enthuW2S ~~
##    .enthuW2P           0.183   2.123   0.086   0.931   -3.978   4.344
##    .enthuW3P           0.139   1.734   0.080   0.936   -3.259   3.537
##    .enthuW4P           0.067   1.695   0.039   0.969   -3.255   3.388
## .enthuW3S ~~
##    .enthuW4S           0.305   2.708   0.113   0.910   -5.002   5.612
## .enthuW1P ~~
##    .enthuW3S           0.190   1.287   0.148   0.882   -2.332   2.713
## .enthuW2P ~~
```

```
##     .enthuW3S              0.199    1.734    0.115    0.908   -3.199    3.597
## .enthuW3S ~~
##     .enthuW3P              0.147    2.216    0.066    0.947   -4.197    4.490
##     .enthuW4P              0.110    2.166    0.051    0.960   -4.136    4.356
## .enthuW1P ~~
##     .enthuW4S              0.196    1.258    0.156    0.876   -2.269    2.662
## .enthuW2P ~~
##     .enthuW4S              0.208    1.695    0.123    0.902   -3.114    3.529
## .enthuW3P ~~
##     .enthuW4S              0.149    2.166    0.069    0.945   -4.097    4.395
## .enthuW4S ~~
##     .enthuW4P              0.105    2.491    0.042    0.966   -4.777    4.987
## .assertW1P ~~
##     .assertW2P             0.207    3.292    0.063    0.950   -6.245    6.659
##     .assertW3P             0.214    2.688    0.080    0.936   -5.054    5.483
##     .assertW4P             0.179    2.628    0.068    0.946   -4.971    5.329
## .assertW2P ~~
##     .assertW3P             0.214    3.622    0.059    0.953   -6.885    7.312
##     .assertW4P             0.180    3.540    0.051    0.959   -6.759    7.119
## .assertW3P ~~
##     .assertW4P             0.167    4.526    0.037    0.971   -8.704    9.037
## .enthuW1P ~~
##     .enthuW2P              0.276    1.261    0.219    0.827   -2.195    2.748
##     .enthuW3P              0.223    1.030    0.216    0.829   -1.796    2.241
##     .enthuW4P              0.181    1.007    0.180    0.857   -1.792    2.154
## .enthuW2P ~~
##     .enthuW3P              0.219    1.387    0.158    0.875   -2.500    2.938
##     .enthuW4P              0.180    1.356    0.133    0.894   -2.478    2.838
## .enthuW3P ~~
##     .enthuW4P              0.174    1.733    0.101    0.920   -3.223    3.572
##    Std.lv   Std.all
##
##    0.315     0.854
##    0.318     0.875
##    0.296     0.812
##    0.247     0.766
##    0.213     0.702
##    0.195     0.653
##    0.169     0.654
##
##    0.325     0.893
##    0.315     0.863
##
##    0.237     0.732
##
##    0.238     0.781
##    0.209     0.702
##    0.173     0.670
##
##    0.321     0.888
##
##    0.201     0.630
##
##    0.200     0.664
```

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```
##
##      0.201     0.682
##      0.173     0.675
##
##      0.203     0.635
##
##      0.208     0.689
##
##      0.197     0.668
##
##      0.205     0.799
##
##      0.281     0.788
##      0.257     0.721
##      0.269     0.738
##      0.188     0.530
##      0.175     0.514
##      0.130     0.448
##      0.083     0.307
##
##      0.298     0.837
##      0.297     0.816
##
##      0.172     0.487
##
##      0.183     0.536
##      0.139     0.479
##      0.067     0.245
##
##      0.305     0.839
##
##      0.190     0.539
##
##      0.199     0.586
##
##      0.147     0.506
##      0.110     0.404
##
##      0.196     0.542
##
##      0.208     0.596
##
##      0.149     0.503
##
##      0.105     0.377
##
##      0.207     0.777
##      0.214     0.820
##      0.179     0.789
##
##      0.214     0.869
##      0.180     0.845
##
##      0.167     0.797
```

```
##
##    0.276    0.815
##    0.223    0.772
##    0.181    0.670
##
##    0.219    0.788
##    0.180    0.693
##
##    0.174    0.788
##
## Intercepts:
##                     Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     .assertW1S         3.461    0.042   82.755    0.000     3.379     3.543
##     .enthuW1S          3.729    0.039   95.071    0.000     3.652     3.806
##     .assertW1P         3.587    0.045   79.736    0.000     3.498     3.675
##     .enthuW1P          3.805    0.047   81.626    0.000     3.714     3.897
##     .assertW2S         3.414    0.044   77.620    0.000     3.328     3.500
##     .enthuW2S          3.697    0.041   89.163    0.000     3.616     3.778
##     .assertW2P         3.649    0.044   83.362    0.000     3.563     3.735
##     .enthuW2P          3.814    0.046   83.527    0.000     3.725     3.904
##     .assertW3S         3.409    0.044   77.471    0.000     3.322     3.495
##     .enthuW3S          3.675    0.042   87.074    0.000     3.593     3.758
##     .assertW3P         3.613    0.044   82.141    0.000     3.527     3.700
##     .enthuW3P          3.853    0.041   94.328    0.000     3.773     3.933
##     .assertW4S         3.454    0.047   73.710    0.000     3.363     3.546
##     .enthuW4S          3.734    0.045   82.923    0.000     3.646     3.823
##     .assertW4P         3.619    0.043   84.431    0.000     3.535     3.703
##     .enthuW4P          3.816    0.042   90.519    0.000     3.733     3.898
##      extra1            0.000                                0.000     0.000
##     .extra2            0.000                                0.000     0.000
##     .extra3            0.000                                0.000     0.000
##     .extra4            0.000                                0.000     0.000
##     Std.lv   Std.all
##      3.461     5.145
##      3.729     5.912
##      3.587     6.039
##      3.805     6.189
##      3.414     5.028
##      3.697     5.836
##      3.649     6.381
##      3.814     6.398
##      3.409     5.046
##      3.675     5.792
##      3.613     6.384
##      3.853     7.461
##      3.454     5.038
##      3.734     5.724
##      3.619     6.958
##      3.816     7.768
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##      0.000     0.000
##
```

```
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .assertW1S        0.368    4.937    0.075    0.941   -9.309   10.045
##     .enthuW1S         0.356    2.430    0.147    0.883   -4.406    5.119
##     .assertW1P        0.283    4.061    0.070    0.944   -7.677    8.243
##     .enthuW1P         0.351    1.556    0.226    0.821   -2.698    3.401
##     .assertW2S        0.369    5.392    0.068    0.945  -10.199   10.937
##     .enthuW2S         0.356    2.654    0.134    0.893   -4.845    5.557
##     .assertW2P        0.251    4.435    0.057    0.955   -8.442    8.944
##     .enthuW2P         0.326    1.699    0.192    0.848   -3.003    3.656
##     .assertW3S        0.360    5.628    0.064    0.949  -10.671   11.391
##     .enthuW3S         0.355    2.770    0.128    0.898   -5.074    5.784
##     .assertW3P        0.241    4.630    0.052    0.958   -8.833    9.315
##     .enthuW3P         0.236    1.773    0.133    0.894   -3.239    3.712
##     .assertW4S        0.362    6.327    0.057    0.954  -12.038   12.762
##     .enthuW4S         0.372    3.113    0.120    0.905   -5.730    6.475
##     .assertW4P        0.181    5.204    0.035    0.972  -10.018   10.381
##     .enthuW4P         0.207    1.993    0.104    0.917   -3.699    4.114
##      extra1           0.085    4.937    0.017    0.986   -9.592    9.761
##     .extra2           0.037    2.148    0.017    0.986   -4.174    4.247
##     .extra3           0.035    2.033    0.017    0.986   -3.950    4.019
##     .extra4           0.016    0.948    0.017    0.986   -1.842    1.875
##    Std.lv  Std.all
##     0.368    0.813
##     0.356    0.895
##     0.283    0.803
##     0.351    0.930
##     0.369    0.800
##     0.356    0.887
##     0.251    0.768
##     0.326    0.918
##     0.360    0.789
##     0.355    0.882
##     0.241    0.753
##     0.236    0.886
##     0.362    0.770
##     0.372    0.875
##     0.181    0.671
##     0.207    0.859
##     1.000    1.000
##     0.398    0.398
##     0.361    0.361
##     0.150    0.150
```

```
semPaths(lsmExtra, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
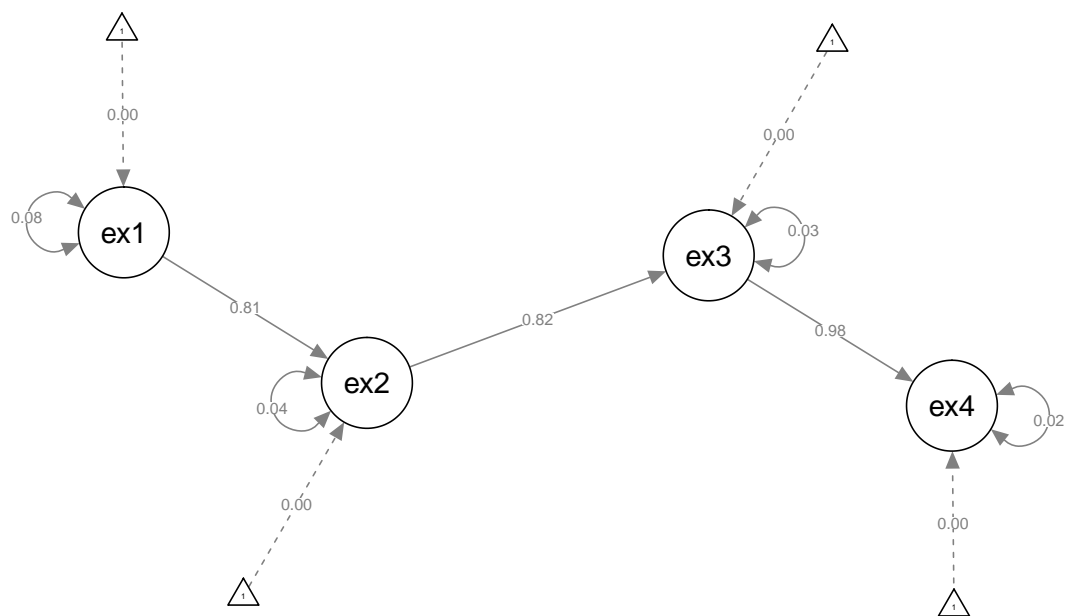
with random parcels

```
lsmExtra <- '

# factor at each time point with same loading
extra1 =~ extraW1S1        + a * extraW1S2 +
          peer * extraW1P1 + aa * extraW1P2

extra2 =~ extraW2S1        + a * extraW2S2 +
          peer * extraW2P1 + aa * extraW2P2

extra3 =~ extraW3S1        + a * extraW3S2 +
          peer * extraW3P1 + aa * extraW3P2

extra4 =~ extraW4S1        + a * extraW4S2 +
          peer * extraW4P1 + aa * extraW4P2

# structural paths between time points
extra4 ~ extra3
extra3 ~ extra2
extra2 ~ extra1

# error covariance - similar parcels across waves
extraW1S1 ~~ extraW2S1 + extraW3S1 + extraW4S1
extraW2S1 ~~ extraW3S1 + extraW4S1
```

```
extraW3S1 ~~ extraW4S1

extraW1S2 ~~ extraW2S2 + extraW3S2 + extraW4S2
extraW2S2 ~~ extraW3S2 + extraW4S2
extraW3S2 ~~ extraW4S2

extraW1P1 ~~ extraW2P1 + extraW3P1 + extraW4P1
extraW2P1 ~~ extraW3P1 + extraW4P1
extraW3P1 ~~ extraW4P1

extraW1P2 ~~ extraW2P2 + extraW3P2 + extraW4P2
extraW2P2 ~~ extraW3P2 + extraW4P2
extraW3P2 ~~ extraW4P2

# error covariance - same method at one wave
extraW1S1 ~~ extraW1S2
extraW1P1 ~~ extraW1P2
extraW2S1 ~~ extraW2S2
extraW2P1 ~~ extraW2P2
extraW3S1 ~~ extraW3S2
extraW3P1 ~~ extraW3P2
extraW4S1 ~~ extraW4S2
extraW4P1 ~~ extraW4P2
'
lsmExtra <- sem(lsmExtra, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Error in validObject(.Object): invalid class "Fit" object: invalid object for slot "fx.group" in clas
```

```
summary(lsmExtra, fit.measures = T, standardized = T, ci = T)
```

```
##    Length     Class      Mode
##         1 character character
```

```
semPaths(lsmExtra, what = "col", whatLabels = "est", structural = T, layout = "spring")
```

```
## Error in semPlotModel.default("\n\n# factor at each time point with same loading\nextra1 =~ extraW1S
```

LSM Neuroticism

with aspects as parcels

```
lsmNeuro <- '

# factor at each time point with same loading
neuro1 =~ volatW1S        + a * withdW1S +
```

```
          peer * volatW1P + aa * withdW1P


neuro2 =~ volatW2S        + a * withdW2S +
          peer * volatW2P + aa * withdW2P


neuro3 =~ volatW3S        + a * withdW3S +
          peer * volatW3P + aa * withdW3P


neuro4 =~ volatW4S        + a * withdW4S +
          peer * volatW4P + aa * withdW4P


# structural paths between time points
neuro4 ~ neuro3
neuro3 ~ neuro2
neuro2 ~ neuro1


# error covariance - similar aspects across waves and informants
volatW1S ~~ volatW2S + volatW3S + volatW4S +
            volatW1P + volatW2P + volatW3P + volatW4P
volatW2S ~~ volatW3S + volatW4S +
            volatW1P + volatW2P + volatW3P + volatW4P
volatW3S ~~ volatW4S +
            volatW1P + volatW2P + volatW3P + volatW4P
volatW4S ~~ volatW1P + volatW2P + volatW3P + volatW4P


withdW1S ~~ withdW2S + withdW3S + withdW4S +
            withdW1P + withdW2P + withdW3P + withdW4P
withdW2S ~~ withdW3S + withdW4S +
            withdW1P + withdW2P + withdW3P + withdW4P
withdW3S ~~ withdW4S +
            withdW1P + withdW2P + withdW3P + withdW4P
withdW4S ~~ withdW1P + withdW2P + withdW3P + withdW4P


volatW1P ~~ volatW2P + volatW3P + volatW4P
volatW2P ~~ volatW3P + volatW4P
volatW3P ~~ volatW4P


withdW1P ~~ withdW2P + withdW3P + withdW4P
withdW2P ~~ withdW3P + withdW4P
withdW3P ~~ withdW4P
'
lsmNeuro <- sem(lsmNeuro, data = data, missing = "ML")


## Warning in lav_object_post_check(object): lavaan WARNING: the covariance matrix of the residuals of
##                 variables (theta) is not positive definite;
##                 use lavInspect(fit, "theta") to investigate.
summary(lsmNeuro, fit.measures = T, standardized = T, ci = T)


## lavaan 0.6-7 ended normally after 190 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                        107
```

```
##    Number of equality constraints                  9
##
##    Number of observations                         259
##    Number of missing patterns                      51
##
## Model Test User Model:
##
##    Test statistic                             216.924
##    Degrees of freedom                              54
##    P-value (Chi-square)                         0.000
##
## Model Test Baseline Model:
##
##    Test statistic                            2496.820
##    Degrees of freedom                             120
##    P-value                                      0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                  0.931
##    Tucker-Lewis Index (TLI)                     0.848
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)            -1657.441
##    Loglikelihood unrestricted model (H1)    -1548.979
##
##    Akaike (AIC)                              3510.881
##    Bayesian (BIC)                            3859.450
##    Sample-size adjusted Bayesian (BIC)       3548.755
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                        0.108
##    90 Percent confidence interval - lower       0.093
##    90 Percent confidence interval - upper       0.123
##    P-value RMSEA <= 0.05                        0.000
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                         0.133
##
## Parameter Estimates:
##
##    Standard errors                           Standard
##    Information                               Observed
##    Observed information based on              Hessian
##
## Latent Variables:
##                 Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   neuro1 =~
##     voltW1S            1.000                                   1.000    1.000
##     wthdW1S   (a)      0.705       NA                             NA       NA
##     voltW1P (peer)     0.969    0.168    5.754    0.000    0.639    1.299
```

```
##     wthdW1P   (aa)     0.638      NA                        NA       NA
##   neuro2 =~
##     voltW2S            1.000                             1.000    1.000
##     wthdW2S    (a)     0.705      NA                        NA       NA
##     voltW2P (peer)     0.969    0.168    5.754    0.000    0.639    1.299
##     wthdW2P   (aa)     0.638      NA                        NA       NA
##   neuro3 =~
##     voltW3S            1.000                             1.000    1.000
##     wthdW3S    (a)     0.705      NA                        NA       NA
##     voltW3P (peer)     0.969    0.168    5.754    0.000    0.639    1.299
##     wthdW3P   (aa)     0.638      NA                        NA       NA
##   neuro4 =~
##     voltW4S            1.000                             1.000    1.000
##     wthdW4S    (a)     0.705      NA                        NA       NA
##     voltW4P (peer)     0.969    0.168    5.754    0.000    0.639    1.299
##     wthdW4P   (aa)     0.638      NA                        NA       NA
##    Std.lv  Std.all
##
##    0.571    0.750
##    0.402    0.579
##    0.553    0.704
##    0.364    0.537
##
##    0.603    0.763
##    0.425    0.605
##    0.585    0.745
##    0.385    0.620
##
##    0.553    0.742
##    0.390    0.567
##    0.536    0.729
##    0.353    0.553
##
##    0.589    0.752
##    0.415    0.612
##    0.571    0.756
##    0.376    0.589
##
## Regressions:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   neuro4 ~
##     neuro3           0.980    0.062   15.859    0.000    0.858    1.101
##   neuro3 ~
##     neuro2           0.870    0.043   20.428    0.000    0.786    0.953
##   neuro2 ~
##     neuro1           0.935    0.057   16.437    0.000    0.823    1.046
##    Std.lv  Std.all
##
##    0.920    0.920
##
##    0.949    0.949
##
##    0.884    0.884
##
```

```
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   .volatW1S ~~
##     .volatW2S         0.193       NA                          NA        NA
##     .volatW3S         0.172       NA                          NA        NA
##     .volatW4S         0.164       NA                          NA        NA
##     .volatW1P        -0.114       NA                          NA        NA
##     .volatW2P        -0.042       NA                          NA        NA
##     .volatW3P        -0.079       NA                          NA        NA
##     .volatW4P        -0.010       NA                          NA        NA
##   .volatW2S ~~
##     .volatW3S         0.204       NA                          NA        NA
##     .volatW4S         0.178       NA                          NA        NA
##   .volatW1P ~~
##     .volatW2S        -0.113       NA                          NA        NA
##   .volatW2S ~~
##     .volatW2P        -0.072       NA                          NA        NA
##     .volatW3P        -0.109       NA                          NA        NA
##     .volatW4P        -0.069       NA                          NA        NA
##   .volatW3S ~~
##     .volatW4S         0.170       NA                          NA        NA
##   .volatW1P ~~
##     .volatW3S        -0.092       NA                          NA        NA
##   .volatW2P ~~
##     .volatW3S        -0.058       NA                          NA        NA
##   .volatW3S ~~
##     .volatW3P        -0.143       NA                          NA        NA
##     .volatW4P        -0.096       NA                          NA        NA
##   .volatW1P ~~
##     .volatW4S        -0.117       NA                          NA        NA
##   .volatW2P ~~
##     .volatW4S        -0.123       NA                          NA        NA
##   .volatW3P ~~
##     .volatW4S        -0.173       NA                          NA        NA
##   .volatW4S ~~
##     .volatW4P        -0.175       NA                          NA        NA
##   .withdW1S ~~
##     .withdW2S         0.224       NA                          NA        NA
##     .withdW3S         0.232       NA                          NA        NA
##     .withdW4S         0.220       NA                          NA        NA
##     .withdW1P         0.009       NA                          NA        NA
##     .withdW2P         0.034       NA                          NA        NA
##     .withdW3P        -0.005       NA                          NA        NA
##     .withdW4P         0.000       NA                          NA        NA
##   .withdW2S ~~
##     .withdW3S         0.234       NA                          NA        NA
##     .withdW4S         0.209       NA                          NA        NA
##   .withdW1P ~~
##     .withdW2S         0.010       NA                          NA        NA
##   .withdW2S ~~
##     .withdW2P         0.011       NA                          NA        NA
##     .withdW3P        -0.034       NA                          NA        NA
##     .withdW4P        -0.024       NA                          NA        NA
##   .withdW3S ~~
```

```
##    .withdW4S         0.231        NA                    NA      NA
## .withdW1P ~~
##    .withdW3S         0.005        NA                    NA      NA
## .withdW2P ~~
##    .withdW3S         0.018        NA                    NA      NA
## .withdW3S ~~
##    .withdW3P        -0.010        NA                    NA      NA
##    .withdW4P        -0.015        NA                    NA      NA
## .withdW1P ~~
##    .withdW4S         0.026        NA                    NA      NA
## .withdW2P ~~
##    .withdW4S         0.035        NA                    NA      NA
## .withdW3P ~~
##    .withdW4S         0.006        NA                    NA      NA
## .withdW4S ~~
##    .withdW4P         0.011        NA                    NA      NA
## .volatW1P ~~
##    .volatW2P         0.193        NA                    NA      NA
##    .volatW3P         0.187        NA                    NA      NA
##    .volatW4P         0.161        NA                    NA      NA
## .volatW2P ~~
##    .volatW3P         0.179        NA                    NA      NA
##    .volatW4P         0.202        NA                    NA      NA
## .volatW3P ~~
##    .volatW4P         0.166        NA                    NA      NA
## .withdW1P ~~
##    .withdW2P         0.204        NA                    NA      NA
##    .withdW3P         0.244        NA                    NA      NA
##    .withdW4P         0.170        NA                    NA      NA
## .withdW2P ~~
##    .withdW3P         0.189        NA                    NA      NA
##    .withdW4P         0.179        NA                    NA      NA
## .withdW3P ~~
##    .withdW4P         0.213        NA                    NA      NA
##    Std.lv  Std.all
##
##    0.193    0.748
##    0.172    0.686
##    0.164    0.630
##   -0.114   -0.406
##   -0.042   -0.160
##   -0.079   -0.314
##   -0.010   -0.040
##
##    0.204    0.801
##    0.178    0.674
##
##   -0.113   -0.398
##
##   -0.072   -0.268
##   -0.109   -0.426
##   -0.069   -0.273
##
##    0.170    0.660
```

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```
##
##     -0.092   -0.329
##
##     -0.058   -0.224
##
##     -0.143   -0.570
##     -0.096   -0.390
##
##     -0.117   -0.408
##
##     -0.123   -0.456
##
##     -0.173   -0.666
##
##     -0.175   -0.685
##
##      0.224    0.707
##      0.232    0.725
##      0.220    0.725
##      0.009    0.027
##      0.034    0.125
##     -0.005   -0.017
##      0.000    0.002
##
##      0.234    0.739
##      0.209    0.697
##
##      0.010    0.031
##
##      0.011    0.040
##     -0.034   -0.113
##     -0.024   -0.082
##
##      0.231    0.760
##
##      0.005    0.014
##
##      0.018    0.066
##
##     -0.010   -0.032
##     -0.015   -0.050
##
##      0.026    0.085
##
##      0.035    0.135
##
##      0.006    0.022
##
##      0.011    0.040
##
##      0.193    0.659
##      0.187    0.666
##      0.161    0.585
##
```

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```
##     0.179    0.679
##     0.202    0.780
##
##     0.166    0.669
##
##     0.204    0.729
##     0.244    0.803
##     0.170    0.576
##
##     0.189    0.729
##     0.179    0.711
##
##     0.213    0.777
##
## Intercepts:
##                  Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     .volatW1S        2.780    0.047   58.711    0.000     2.687     2.872
##     .withdW1S        2.994    0.043   69.352    0.000     2.910     3.079
##     .volatW1P        2.537    0.060   42.428    0.000     2.420     2.655
##     .withdW1P        2.561    0.052   49.665    0.000     2.459     2.662
##     .volatW2S        2.788    0.051   54.405    0.000     2.687     2.888
##     .withdW2S        3.030    0.046   65.615    0.000     2.940     3.121
##     .volatW2P        2.601    0.059   44.057    0.000     2.486     2.717
##     .withdW2P        2.569    0.047   54.263    0.000     2.476     2.661
##     .volatW3S        2.751    0.049   56.247    0.000     2.655     2.846
##     .withdW3S        3.001    0.045   66.119    0.000     2.912     3.090
##     .volatW3P        2.598    0.057   45.265    0.000     2.485     2.710
##     .withdW3P        2.598    0.049   52.543    0.000     2.501     2.695
##     .volatW4S        2.772    0.055   50.567    0.000     2.665     2.880
##     .withdW4S        2.964    0.047   63.139    0.000     2.872     3.056
##     .volatW4P        2.669    0.061   43.656    0.000     2.549     2.789
##     .withdW4P        2.608    0.053   48.823    0.000     2.504     2.713
##      neuro1          0.000                               0.000     0.000
##     .neuro2          0.000                               0.000     0.000
##     .neuro3          0.000                               0.000     0.000
##     .neuro4          0.000                               0.000     0.000
##     Std.lv   Std.all
##     2.780    3.650
##     2.994    4.312
##     2.537    3.230
##     2.561    3.772
##     2.788    3.525
##     3.030    4.309
##     2.601    3.312
##     2.569    4.132
##     2.751    3.694
##     3.001    4.365
##     2.598    3.536
##     2.598    4.074
##     2.772    3.540
##     2.964    4.370
##     2.669    3.534
##     2.608    4.088
##     0.000    0.000
```

```
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      .volatW1S        0.254       NA                         NA       NA
##      .withdW1S        0.320       NA                         NA       NA
##      .volatW1P        0.311       NA                         NA       NA
##      .withdW1P        0.328       NA                         NA       NA
##      .volatW2S        0.261       NA                         NA       NA
##      .withdW2S        0.314       NA                         NA       NA
##      .volatW2P        0.275       NA                         NA       NA
##      .withdW2P        0.238       NA                         NA       NA
##      .volatW3S        0.249       NA                         NA       NA
##      .withdW3S        0.321       NA                         NA       NA
##      .volatW3P        0.253       NA                         NA       NA
##      .withdW3P        0.282       NA                         NA       NA
##      .volatW4S        0.267       NA                         NA       NA
##      .withdW4S        0.288       NA                         NA       NA
##      .volatW4P        0.245       NA                         NA       NA
##      .withdW4P        0.266       NA                         NA       NA
##       neuro1          0.326       NA                         NA       NA
##      .neuro2          0.079       NA                         NA       NA
##      .neuro3          0.030       NA                         NA       NA
##      .neuro4          0.053       NA                         NA       NA
##    Std.lv  Std.all
##     0.254    0.438
##     0.320    0.664
##     0.311    0.504
##     0.328    0.712
##     0.261    0.418
##     0.314    0.634
##     0.275    0.446
##     0.238    0.616
##     0.249    0.449
##     0.321    0.679
##     0.253    0.468
##     0.282    0.694
##     0.267    0.435
##     0.288    0.626
##     0.245    0.429
##     0.266    0.653
##     1.000    1.000
##     0.218    0.218
##     0.099    0.099
##     0.154    0.154
```

```r
semPaths(lsmNeuro, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
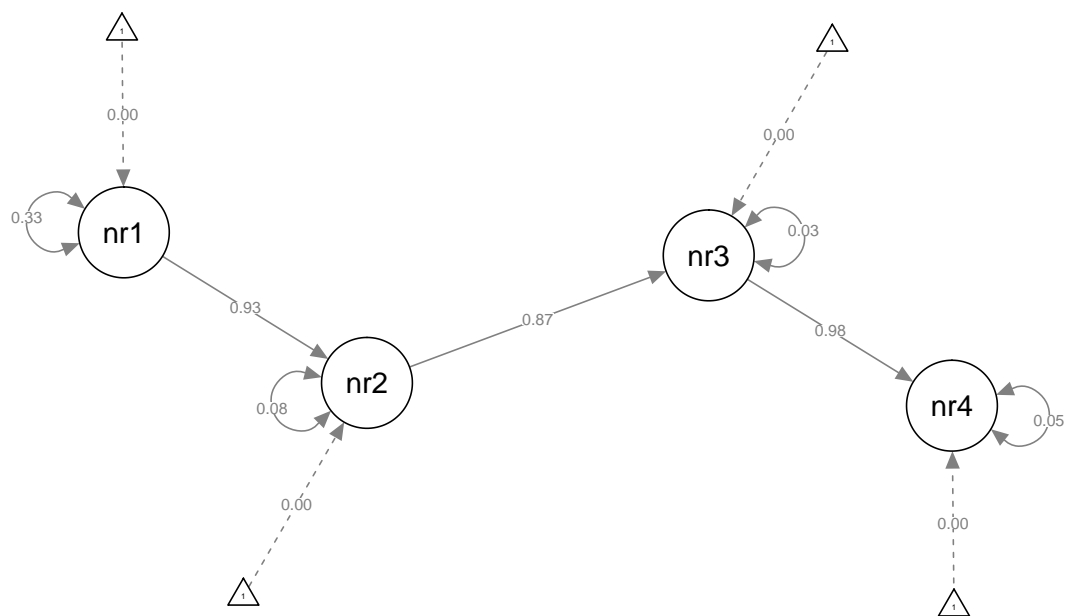
with random parcels

```
lsmNeuro <- '

# factor at each time point with same loading
neuro1 =~ neuroW1S1        + a * neuroW1S2 +
          peer * neuroW1P1 + aa * neuroW1P2

neuro2 =~ neuroW2S1        + a * neuroW2S2 +
          peer * neuroW2P1 + aa * neuroW2P2

neuro3 =~ neuroW3S1        + a * neuroW3S2 +
          peer * neuroW3P1 + aa * neuroW3P2

neuro4 =~ neuroW4S1        + a * neuroW4S2 +
          peer * neuroW4P1 + aa * neuroW4P2

# structural paths between time points
neuro4 ~ neuro3
neuro3 ~ neuro2
neuro2 ~ neuro1

# error covariance - similar parcels across waves
neuroW1S1 ~~ neuroW2S1 + neuroW3S1 + neuroW4S1
neuroW2S1 ~~ neuroW3S1 + neuroW4S1
```

```
neuroW3S1 ~~ neuroW4S1

neuroW1S2 ~~ neuroW2S2 + neuroW3S2 + neuroW4S2
neuroW2S2 ~~ neuroW3S2 + neuroW4S2
neuroW3S2 ~~ neuroW4S2

neuroW1P1 ~~ neuroW2P1 + neuroW3P1 + neuroW4P1
neuroW2P1 ~~ neuroW3P1 + neuroW4P1
neuroW3P1 ~~ neuroW4P1

neuroW1P2 ~~ neuroW2P2 + neuroW3P2 + neuroW4P2
neuroW2P2 ~~ neuroW3P2 + neuroW4P2
neuroW3P2 ~~ neuroW4P2

# error covariance – same method at one wave
neuroW1S1 ~~ neuroW1S2
neuroW1P1 ~~ neuroW1P2
neuroW2S1 ~~ neuroW2S2
neuroW2P1 ~~ neuroW2P2
neuroW3S1 ~~ neuroW3S2
neuroW3P1 ~~ neuroW3P2
neuroW4S1 ~~ neuroW4S2
neuroW4P1 ~~ neuroW4P2
'
lsmNeuro <- sem(lsmNeuro, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!
```

```
summary(lsmNeuro, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 did NOT end normally after 290 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA
```

```
## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on               Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   neuro1 =~
##     nerW1S1            1.000                                1.000    1.000
##     nerW1S2   (a)      0.983      NA                           NA       NA
##     nerW1P1 (peer)     0.835      NA                           NA       NA
##     nerW1P2  (aa)      0.678      NA                           NA       NA
##   neuro2 =~
##     nerW2S1            1.000                                1.000    1.000
##     nerW2S2   (a)      0.983      NA                           NA       NA
##     nerW2P1 (peer)     0.835      NA                           NA       NA
##     nerW2P2  (aa)      0.678      NA                           NA       NA
##   neuro3 =~
##     nerW3S1            1.000                                1.000    1.000
##     nerW3S2   (a)      0.983      NA                           NA       NA
##     nerW3P1 (peer)     0.835      NA                           NA       NA
##     nerW3P2  (aa)      0.678      NA                           NA       NA
##   neuro4 =~
##     nerW4S1            1.000                                1.000    1.000
##     nerW4S2   (a)      0.983      NA                           NA       NA
##     nerW4P1 (peer)     0.835      NA                           NA       NA
##     nerW4P2  (aa)      0.678      NA                           NA       NA
##    Std.lv  Std.all
##
##    1.693    0.927
##    1.664    0.908
##    1.413    0.864
##    1.148    0.902
##
##    2.444    0.975
##    2.403    0.976
##    2.041    0.963
##    1.657    0.930
##
##    2.523    0.973
##    2.480    0.970
##    2.107    0.949
##    1.711    0.931
##
##    2.522    0.964
##    2.480    0.963
##    2.106    0.936
##    1.710    0.931
##
## Regressions:
```

```
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   neuro4 ~
##     neuro3            1.000      NA                          NA       NA
##   neuro3 ~
##     neuro2            1.029      NA                          NA       NA
##   neuro2 ~
##     neuro1            1.380      NA                          NA       NA
##    Std.lv  Std.all
##
##     1.000    1.000
##
##     0.997    0.997
##
##     0.955    0.955
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .neuroW1S1 ~~
##     .neuroW2S1        0.037      NA                          NA       NA
##     .neuroW3S1        0.059      NA                          NA       NA
##     .neuroW4S1        0.043      NA                          NA       NA
##   .neuroW2S1 ~~
##     .neuroW3S1        0.040      NA                          NA       NA
##     .neuroW4S1        0.020      NA                          NA       NA
##   .neuroW3S1 ~~
##     .neuroW4S1        0.049      NA                          NA       NA
##   .neuroW1S2 ~~
##     .neuroW2S2       -0.006      NA                          NA       NA
##     .neuroW3S2       -0.004      NA                          NA       NA
##     .neuroW4S2        0.015      NA                          NA       NA
##   .neuroW2S2 ~~
##     .neuroW3S2       -0.014      NA                          NA       NA
##     .neuroW4S2        0.005      NA                          NA       NA
##   .neuroW3S2 ~~
##     .neuroW4S2       -0.019      NA                          NA       NA
##   .neuroW1P1 ~~
##     .neuroW2P1        0.062      NA                          NA       NA
##     .neuroW3P1        0.111      NA                          NA       NA
##     .neuroW4P1        0.162      NA                          NA       NA
##   .neuroW2P1 ~~
##     .neuroW3P1        0.017      NA                          NA       NA
##     .neuroW4P1        0.255      NA                          NA       NA
##   .neuroW3P1 ~~
##     .neuroW4P1        0.258      NA                          NA       NA
##   .neuroW1P2 ~~
##     .neuroW2P2        0.298      NA                          NA       NA
##     .neuroW3P2        0.303      NA                          NA       NA
##     .neuroW4P2        0.303      NA                          NA       NA
##   .neuroW2P2 ~~
##     .neuroW3P2        0.449      NA                          NA       NA
##     .neuroW4P2        0.449      NA                          NA       NA
##   .neuroW3P2 ~~
##     .neuroW4P2        0.453      NA                          NA       NA
##   .neuroW1S1 ~~
```

```
##    .neuroW1S2             0.450          NA                           NA          NA
## .neuroW1P1 ~~
##    .neuroW1P2             0.228          NA                           NA          NA
## .neuroW2S1 ~~
##    .neuroW2S2             0.236          NA                           NA          NA
## .neuroW2P1 ~~
##    .neuroW2P2            -0.012          NA                           NA          NA
## .neuroW3S1 ~~
##    .neuroW3S2             0.306          NA                           NA          NA
## .neuroW3P1 ~~
##    .neuroW3P2            -0.000          NA                           NA          NA
## .neuroW4S1 ~~
##    .neuroW4S2             0.406          NA                           NA          NA
## .neuroW4P1 ~~
##    .neuroW4P2            -0.000          NA                           NA          NA
##    Std.lv  Std.all
##
##    0.037    0.097
##    0.059    0.145
##    0.043    0.089
##
##    0.040    0.121
##    0.020    0.051
##
##    0.049    0.118
##
##   -0.006   -0.014
##   -0.004   -0.009
##    0.015    0.027
##
##   -0.014   -0.042
##    0.005    0.014
##
##   -0.019   -0.045
##
##    0.062    0.132
##    0.111    0.193
##    0.162    0.250
##
##    0.017    0.044
##    0.255    0.564
##
##    0.258    0.469
##
##    0.298    0.828
##    0.303    0.822
##    0.303    0.823
##
##    0.449    1.018
##    0.449    1.018
##
##    0.453    1.000
##
##    0.450    0.857
```

266

```
##
##      0.228     0.506
##
##      0.236     0.789
##
##     -0.012    -0.033
##
##      0.306     0.827
##
##     -0.000    -0.000
##
##      0.406     0.839
##
##     -0.000    -0.000
##
## Intercepts:
##                      Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     .neuroW1S1         1.261     NA                           NA        NA
##     .neuroW1S2         1.217     NA                           NA        NA
##     .neuroW1P1         0.772     NA                           NA        NA
##     .neuroW1P2         1.036     NA                           NA        NA
##     .neuroW2S1         0.364     NA                           NA        NA
##     .neuroW2S2         0.346     NA                           NA        NA
##     .neuroW2P1         0.176     NA                           NA        NA
##     .neuroW2P2         0.332     NA                           NA        NA
##     .neuroW3S1         0.211     NA                           NA        NA
##     .neuroW3S2         0.199     NA                           NA        NA
##     .neuroW3P1         0.124     NA                           NA        NA
##     .neuroW3P2         0.260     NA                           NA        NA
##     .neuroW4S1         0.194     NA                           NA        NA
##     .neuroW4S2         0.165     NA                           NA        NA
##     .neuroW4P1         0.123     NA                           NA        NA
##     .neuroW4P2         0.260     NA                           NA        NA
##      neuro1            0.000                            0.000     0.000
##     .neuro2            0.000                            0.000     0.000
##     .neuro3            0.000                            0.000     0.000
##     .neuro4            0.000                            0.000     0.000
##     Std.lv   Std.all
##      1.261     0.691
##      1.217     0.664
##      0.772     0.472
##      1.036     0.815
##      0.364     0.145
##      0.346     0.141
##      0.176     0.083
##      0.332     0.186
##      0.211     0.081
##      0.199     0.078
##      0.124     0.056
##      0.260     0.141
##      0.194     0.074
##      0.165     0.064
##      0.123     0.055
##      0.260     0.141
```

```
##       0.000       0.000
##       0.000       0.000
##       0.000       0.000
##       0.000       0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .neuroW1S1         0.467       NA                        NA       NA
##    .neuroW1S2         0.589       NA                        NA       NA
##    .neuroW1P1         0.679       NA                        NA       NA
##    .neuroW1P2         0.301       NA                        NA       NA
##    .neuroW2S1         0.314       NA                        NA       NA
##    .neuroW2S2         0.285       NA                        NA       NA
##    .neuroW2P1         0.327       NA                        NA       NA
##    .neuroW2P2         0.430       NA                        NA       NA
##    .neuroW3S1         0.355       NA                        NA       NA
##    .neuroW3S2         0.386       NA                        NA       NA
##    .neuroW3P1         0.487       NA                        NA       NA
##    .neuroW3P2         0.453       NA                        NA       NA
##    .neuroW4S1         0.491       NA                        NA       NA
##    .neuroW4S2         0.477       NA                        NA       NA
##    .neuroW4P1         0.624       NA                        NA       NA
##    .neuroW4P2         0.453       NA                        NA       NA
##     neuro1            2.865       NA                        NA       NA
##    .neuro2            0.520       NA                        NA       NA
##    .neuro3            0.040       NA                        NA       NA
##    .neuro4            0.000       NA                        NA       NA
##    Std.lv  Std.all
##     0.467    0.140
##     0.589    0.175
##     0.679    0.254
##     0.301    0.186
##     0.314    0.050
##     0.285    0.047
##     0.327    0.073
##     0.430    0.135
##     0.355    0.053
##     0.386    0.059
##     0.487    0.099
##     0.453    0.134
##     0.491    0.072
##     0.477    0.072
##     0.624    0.123
##     0.453    0.134
##     1.000    1.000
##     0.087    0.087
##     0.006    0.006
##     0.000    0.000
```

```r
semPaths(lsmNeuro, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
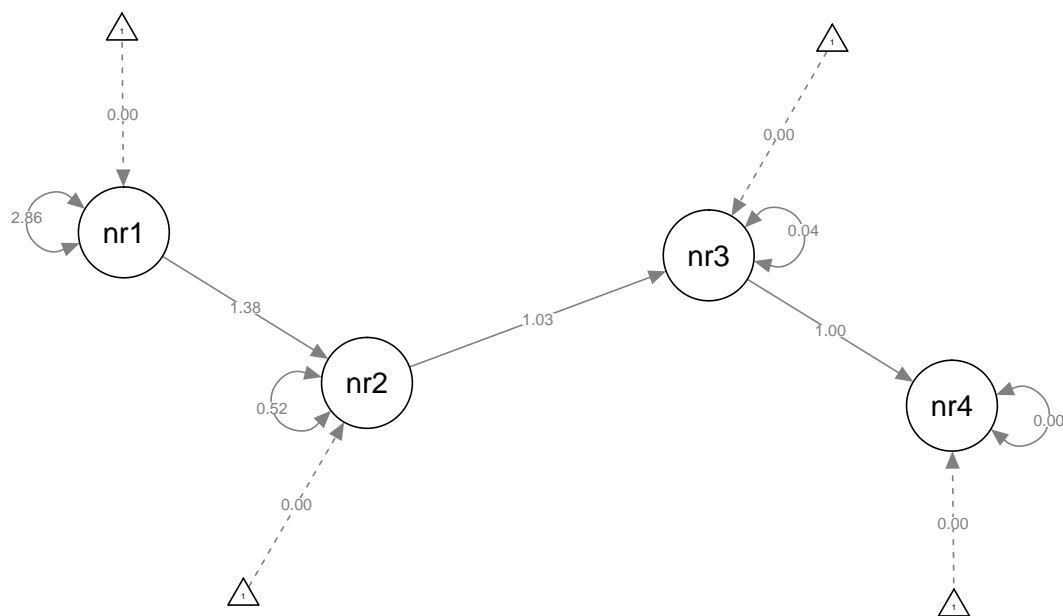
LSM Openness domain

with aspects as parcels

```
lsmOpend <- '

# factor at each time point with same loading
opend1 =~ intelW1S        + a * openaW1S +
         peer * intelW1P + aa * openaW1P

opend2 =~ intelW2S        + a * openaW2S +
         peer * intelW2P + aa * openaW2P

opend3 =~ intelW3S        + a * openaW3S +
         peer * intelW3P + aa * openaW3P

opend4 =~ intelW4S        + a * openaW4S +
         peer * intelW4P + aa * openaW4P

# structural paths between time points
opend4 ~ opend3
opend3 ~ opend2
opend2 ~ opend1

# error covariance - similar aspects across waves and informants
intelW1S ~~ intelW2S + intelW3S + intelW4S +
```

```
        intelW1P + intelW2P + intelW3P + intelW4P
intelW2S ~~ intelW3S + intelW4S +
        intelW1P + intelW2P + intelW3P + intelW4P
intelW3S ~~ intelW4S +
        intelW1P + intelW2P + intelW3P + intelW4P
intelW4S ~~ intelW1P + intelW2P + intelW3P + intelW4P

openaW1S ~~ openaW2S + openaW3S + openaW4S +
        openaW1P + openaW2P + openaW3P + openaW4P
openaW2S ~~ openaW3S + openaW4S +
        openaW1P + openaW2P + openaW3P + openaW4P
openaW3S ~~ openaW4S +
        openaW1P + openaW2P + openaW3P + openaW4P
openaW4S ~~ openaW1P + openaW2P + openaW3P + openaW4P

intelW1P ~~ intelW2P + intelW3P + intelW4P
intelW2P ~~ intelW3P + intelW4P
intelW3P ~~ intelW4P

openaW1P ~~ openaW2P + openaW3P + openaW4P
openaW2P ~~ openaW3P + openaW4P
openaW3P ~~ openaW4P
'
lsmOpend <- sem(lsmOpend, data = data, missing = "ML")
summary(lsmOpend, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 266 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                        107
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                               120.793
##   Degrees of freedom                                54
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2293.599
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.969
##   Tucker-Lewis Index (TLI)                       0.932
##
## Loglikelihood and Information Criteria:
```

```
##
##   Loglikelihood user model (H0)              -1046.743
##   Loglikelihood unrestricted model (H1)       -986.347
##
##   Akaike (AIC)                               2289.487
##   Bayesian (BIC)                             2638.056
##   Sample-size adjusted Bayesian (BIC)        2327.360
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.069
##   90 Percent confidence interval - lower         0.053
##   90 Percent confidence interval - upper         0.086
##   P-value RMSEA <= 0.05                          0.030
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.078
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   opend1 =~
##     intlW1S            1.000                                    1.000    1.000
##     openW1S   (a)      1.626      NA                               NA       NA
##     intlW1P (peer)     1.495    0.370    4.044    0.000    0.770    2.220
##     openW1P  (aa)      1.928      NA                               NA       NA
##   opend2 =~
##     intlW2S            1.000                                    1.000    1.000
##     openW2S   (a)      1.626      NA                               NA       NA
##     intlW2P (peer)     1.495    0.370    4.044    0.000    0.770    2.220
##     openW2P  (aa)      1.928      NA                               NA       NA
##   opend3 =~
##     intlW3S            1.000                                    1.000    1.000
##     openW3S   (a)      1.626      NA                               NA       NA
##     intlW3P (peer)     1.495    0.370    4.044    0.000    0.770    2.220
##     openW3P  (aa)      1.928      NA                               NA       NA
##   opend4 =~
##     intlW4S            1.000                                    1.000    1.000
##     openW4S   (a)      1.626      NA                               NA       NA
##     intlW4P (peer)     1.495    0.370    4.044    0.000    0.770    2.220
##     openW4P  (aa)      1.928      NA                               NA       NA
##   Std.lv  Std.all
##
##   0.176    0.324
##   0.286    0.458
##   0.263    0.496
##   0.339    0.680
##
```

```
##     0.216    0.397
##     0.352    0.534
##     0.323    0.635
##     0.417    0.747
##
##     0.185    0.340
##     0.300    0.484
##     0.276    0.482
##     0.356    0.623
##
##     0.192    0.366
##     0.312    0.494
##     0.286    0.522
##     0.369    0.665
##
## Regressions:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   opend4 ~
##     opend3            0.959    0.095   10.127    0.000     0.773     1.144
##   opend3 ~
##     opend2            0.826    0.065   12.647    0.000     0.698     0.954
##   opend2 ~
##     opend1            1.011    0.107    9.405    0.000     0.800     1.221
##    Std.lv  Std.all
##
##     0.925    0.925
##
##     0.967    0.967
##
##     0.822    0.822
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   .intelW1S ~~
##     .intelW2S         0.199       NA                          NA        NA
##     .intelW3S         0.198       NA                          NA        NA
##     .intelW4S         0.184       NA                          NA        NA
##     .intelW1P         0.038       NA                          NA        NA
##     .intelW2P         0.007       NA                          NA        NA
##     .intelW3P         0.035       NA                          NA        NA
##     .intelW4P        -0.002       NA                          NA        NA
##   .intelW2S ~~
##     .intelW3S         0.203       NA                          NA        NA
##     .intelW4S         0.191       NA                          NA        NA
##   .intelW1P ~~
##     .intelW2S         0.036       NA                          NA        NA
##   .intelW2S ~~
##     .intelW2P        -0.003       NA                          NA        NA
##     .intelW3P         0.026       NA                          NA        NA
##     .intelW4P        -0.015       NA                          NA        NA
##   .intelW3S ~~
##     .intelW4S         0.203       NA                          NA        NA
##   .intelW1P ~~
##     .intelW3S         0.057       NA                          NA        NA
```

```
##   .intelW2P ~~
##      .intelW3S         0.013        NA                        NA        NA
##   .intelW3S ~~
##      .intelW3P         0.026        NA                        NA        NA
##      .intelW4P        -0.013        NA                        NA        NA
##   .intelW1P ~~
##      .intelW4S         0.038        NA                        NA        NA
##   .intelW2P ~~
##      .intelW4S         0.002        NA                        NA        NA
##   .intelW3P ~~
##      .intelW4S         0.019        NA                        NA        NA
##   .intelW4S ~~
##      .intelW4P        -0.027        NA                        NA        NA
##   .openaW1S ~~
##      .openaW2S         0.255        NA                        NA        NA
##      .openaW3S         0.256        NA                        NA        NA
##      .openaW4S         0.251        NA                        NA        NA
##      .openaW1P         0.059        NA                        NA        NA
##      .openaW2P         0.089        NA                        NA        NA
##      .openaW3P         0.115        NA                        NA        NA
##      .openaW4P         0.098        NA                        NA        NA
##   .openaW2S ~~
##      .openaW3S         0.257        NA                        NA        NA
##      .openaW4S         0.255        NA                        NA        NA
##   .openaW1P ~~
##      .openaW2S         0.064        NA                        NA        NA
##   .openaW2S ~~
##      .openaW2P         0.051        NA                        NA        NA
##      .openaW3P         0.087        NA                        NA        NA
##      .openaW4P         0.075        NA                        NA        NA
##   .openaW3S ~~
##      .openaW4S         0.250        NA                        NA        NA
##   .openaW1P ~~
##      .openaW3S         0.064        NA                        NA        NA
##   .openaW2P ~~
##      .openaW3S         0.057        NA                        NA        NA
##   .openaW3S ~~
##      .openaW3P         0.083        NA                        NA        NA
##      .openaW4P         0.066        NA                        NA        NA
##   .openaW1P ~~
##      .openaW4S         0.072        NA                        NA        NA
##   .openaW2P ~~
##      .openaW4S         0.072        NA                        NA        NA
##   .openaW3P ~~
##      .openaW4S         0.098        NA                        NA        NA
##   .openaW4S ~~
##      .openaW4P         0.083        NA                        NA        NA
##   .intelW1P ~~
##      .intelW2P         0.140        NA                        NA        NA
##      .intelW3P         0.170        NA                        NA        NA
##      .intelW4P         0.150        NA                        NA        NA
##   .intelW2P ~~
##      .intelW3P         0.166        NA                        NA        NA
##      .intelW4P         0.124        NA                        NA        NA
```

```
##   .intelW3P ~~
##     .intelW4P              0.171       NA                        NA        NA
##   .openaW1P ~~
##     .openaW2P              0.089       NA                        NA        NA
##     .openaW3P              0.117       NA                        NA        NA
##     .openaW4P              0.124       NA                        NA        NA
##   .openaW2P ~~
##     .openaW3P              0.118       NA                        NA        NA
##     .openaW4P              0.107       NA                        NA        NA
##   .openaW3P ~~
##     .openaW4P              0.158       NA                        NA        NA
##    Std.lv  Std.all
##
##     0.199    0.774
##     0.198    0.753
##     0.184    0.733
##     0.038    0.162
##     0.007    0.037
##     0.035    0.134
##    -0.002   -0.008
##
##     0.203    0.793
##     0.191    0.782
##
##     0.036    0.155
##
##    -0.003   -0.016
##     0.026    0.104
##    -0.015   -0.063
##
##     0.203    0.814
##
##     0.057    0.244
##
##     0.013    0.065
##
##     0.026    0.103
##    -0.013   -0.054
##
##     0.038    0.171
##
##     0.002    0.012
##
##     0.019    0.076
##
##    -0.027   -0.119
##
##     0.255    0.825
##     0.256    0.851
##     0.251    0.825
##     0.059    0.291
##     0.089    0.433
##     0.115    0.465
##     0.098    0.424
```

```
## 
##      0.257    0.852
##      0.255    0.837
## 
##      0.064    0.316
## 
##      0.051    0.249
##      0.087    0.350
##      0.075    0.325
## 
##      0.250    0.841
## 
##      0.064    0.321
## 
##      0.057    0.284
## 
##      0.083    0.342
##      0.066    0.291
## 
##      0.072    0.358
## 
##      0.072    0.353
## 
##      0.098    0.400
## 
##      0.083    0.365
## 
##      0.140    0.771
##      0.170    0.736
##      0.150    0.696
## 
##      0.166    0.842
##      0.124    0.672
## 
##      0.171    0.728
## 
##      0.089    0.659
##      0.117    0.717
##      0.124    0.818
## 
##      0.118    0.712
##      0.107    0.696
## 
##      0.158    0.852
## 
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     .intelW1S         3.666    0.034  108.517    0.000     3.600     3.732
##     .openaW1S         3.799    0.039   97.829    0.000     3.723     3.875
##     .intelW1P         3.993    0.041   97.308    0.000     3.913     4.074
##     .openaW1P         3.607    0.038   95.890    0.000     3.534     3.681
##     .intelW2S         3.614    0.036  100.934    0.000     3.544     3.684
##     .openaW2S         3.772    0.043   88.082    0.000     3.688     3.856
##     .intelW2P         3.972    0.040  100.237    0.000     3.894     4.050
```

```
##    .openaW2P          3.602   0.042    85.294   0.000     3.519    3.685
##    .intelW3S          3.641   0.036   101.320   0.000     3.570    3.711
##    .openaW3S          3.800   0.040    94.234   0.000     3.721    3.879
##    .intelW3P          3.950   0.045    86.826   0.000     3.861    4.039
##    .openaW3P          3.587   0.043    82.566   0.000     3.502    3.672
##    .intelW4S          3.659   0.036   100.624   0.000     3.588    3.730
##    .openaW4S          3.826   0.043    89.612   0.000     3.742    3.910
##    .intelW4P          3.884   0.048    80.877   0.000     3.790    3.978
##    .openaW4P          3.580   0.044    80.864   0.000     3.493    3.667
##     opend1            0.000                               0.000    0.000
##    .opend2            0.000                               0.000    0.000
##    .opend3            0.000                               0.000    0.000
##    .opend4            0.000                               0.000    0.000
##    Std.lv   Std.all
##    3.666    6.747
##    3.799    6.081
##    3.993    7.532
##    3.607    7.237
##    3.614    6.628
##    3.772    5.732
##    3.972    7.803
##    3.602    6.457
##    3.641    6.705
##    3.800    6.126
##    3.950    6.895
##    3.587    6.278
##    3.659    6.985
##    3.826    6.071
##    3.884    7.072
##    3.580    6.443
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##    .intelW1S          0.264     NA                                NA       NA
##    .openaW1S          0.308     NA                                NA       NA
##    .intelW1P          0.212     NA                                NA       NA
##    .openaW1P          0.134     NA                                NA       NA
##    .intelW2S          0.250     NA                                NA       NA
##    .openaW2S          0.309     NA                                NA       NA
##    .intelW2P          0.155     NA                                NA       NA
##    .openaW2P          0.137     NA                                NA       NA
##    .intelW3S          0.261     NA                                NA       NA
##    .openaW3S          0.295     NA                                NA       NA
##    .intelW3P          0.252     NA                                NA       NA
##    .openaW3P          0.200     NA                                NA       NA
##    .intelW4S          0.238     NA                                NA       NA
##    .openaW4S          0.300     NA                                NA       NA
##    .intelW4P          0.219     NA                                NA       NA
##    .openaW4P          0.172     NA                                NA       NA
##     opend1            0.031     NA                                NA       NA
```

```
##     .opend2              0.015       NA                        NA        NA
##     .opend3              0.002       NA                        NA        NA
##     .opend4              0.005       NA                        NA        NA
##     Std.lv  Std.all
##     0.264    0.895
##     0.308    0.791
##     0.212    0.754
##     0.134    0.538
##     0.250    0.843
##     0.309    0.714
##     0.155    0.597
##     0.137    0.442
##     0.261    0.884
##     0.295    0.765
##     0.252    0.767
##     0.200    0.611
##     0.238    0.866
##     0.300    0.756
##     0.219    0.728
##     0.172    0.558
##     1.000    1.000
##     0.325    0.325
##     0.065    0.065
##     0.145    0.145
```

```
semPaths(lsmOpend, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
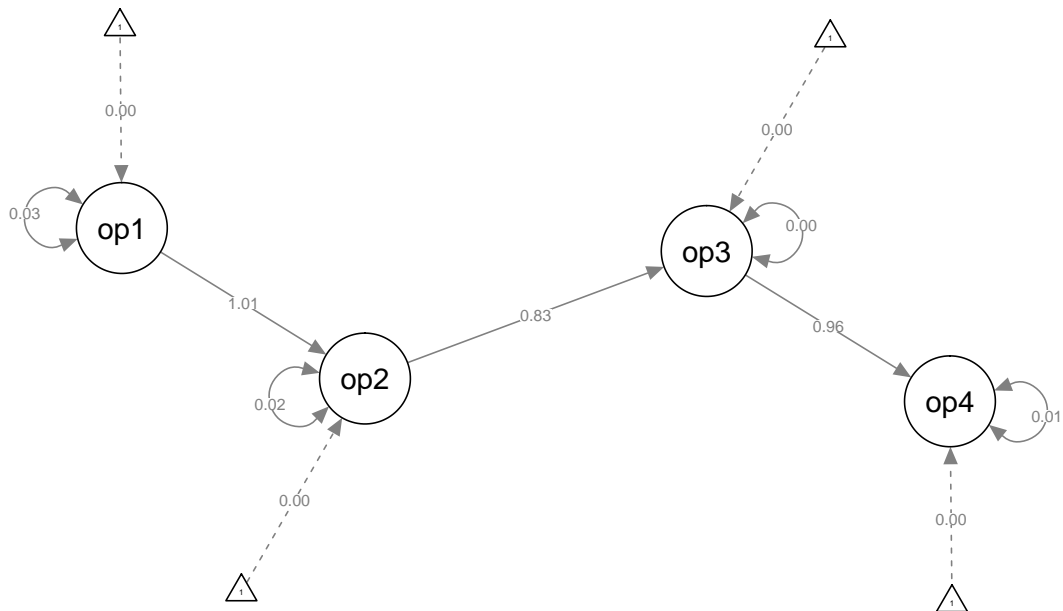
with random parcels

```
lsmOpend <- '

# factor at each time point with same loading
opend1 =~ opendW1S1          + a * opendW1S2 +
            peer * opendW1P1 + aa * opendW1P2

opend2 =~ opendW2S1          + a * opendW2S2 +
            peer * opendW2P1 + aa * opendW2P2

opend3 =~ opendW3S1          + a * opendW3S2 +
            peer * opendW3P1 + aa * opendW3P2

opend4 =~ opendW4S1          + a * opendW4S2 +
            peer * opendW4P1 + aa * opendW4P2

# structural paths between time points
opend4 ~ opend3
opend3 ~ opend2
opend2 ~ opend1

# error covariance - similar parcels across waves
opendW1S1 ~~ opendW2S1 + opendW3S1 + opendW4S1
opendW2S1 ~~ opendW3S1 + opendW4S1
opendW3S1 ~~ opendW4S1

opendW1S2 ~~ opendW2S2 + opendW3S2 + opendW4S2
opendW2S2 ~~ opendW3S2 + opendW4S2
opendW3S2 ~~ opendW4S2

opendW1P1 ~~ opendW2P1 + opendW3P1 + opendW4P1
opendW2P1 ~~ opendW3P1 + opendW4P1
opendW3P1 ~~ opendW4P1

opendW1P2 ~~ opendW2P2 + opendW3P2 + opendW4P2
opendW2P2 ~~ opendW3P2 + opendW4P2
opendW3P2 ~~ opendW4P2

# error covariance - same method at one wave
opendW1S1 ~~ opendW1S2
opendW1P1 ~~ opendW1P2
opendW2S1 ~~ opendW2S2
opendW2P1 ~~ opendW2P2
opendW3S1 ~~ opendW3S2
opendW3P1 ~~ opendW3P2
opendW4S1 ~~ opendW4S2
opendW4P1 ~~ opendW4P2
'
lsmOpend <- sem(lsmOpend, data = data, missing = "ML")
```

```
## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
```

```
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!

## Warning in lav_model_estimate(lavmodel = lavmodel, lavpartable = lavpartable, :
## lavaan WARNING: the optimizer warns that a solution has NOT been found!
```

```r
summary(lsmOpend, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 did NOT end normally after 442 iterations
## ** WARNING ** Estimates below are most likely unreliable
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        51
##
## Model Test User Model:
##
##   Test statistic                                    NA
##   Degrees of freedom                                NA

## Warning in .local(object, ...): lavaan WARNING: fit measures not available if model did not converge

##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   opend1 =~
##     opnW1S1            1.000                               1.000    1.000
##     opnW1S2    (a)     1.008       NA                         NA       NA
##     opnW1P1 (peer)     1.055       NA                         NA       NA
##     opnW1P2   (aa)     0.960       NA                         NA       NA
##   opend2 =~
##     opnW2S1            1.000                               1.000    1.000
##     opnW2S2    (a)     1.008       NA                         NA       NA
##     opnW2P1 (peer)     1.055       NA                         NA       NA
##     opnW2P2   (aa)     0.960       NA                         NA       NA
##   opend3 =~
##     opnW3S1            1.000                               1.000    1.000
##     opnW3S2    (a)     1.008       NA                         NA       NA
##     opnW3P1 (peer)     1.055       NA                         NA       NA
##     opnW3P2   (aa)     0.960       NA                         NA       NA
##   opend4 =~
##     opnW4S1            1.000                               1.000    1.000
##     opnW4S2    (a)     1.008       NA                         NA       NA
##     opnW4P1 (peer)     1.055       NA                         NA       NA
##     opnW4P2   (aa)     0.960       NA                         NA       NA
```

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```
##     Std.lv  Std.all
##
##     1.938    0.937
##     1.954    0.948
##     2.044    0.915
##     1.861    0.951
##
##     2.841    0.991
##     2.865    0.992
##     2.996    0.982
##     2.727    0.976
##
##     2.842    0.990
##     2.866    0.989
##     2.997    0.984
##     2.728    0.976
##
##     2.843    0.980
##     2.867    0.981
##     2.999    0.971
##     2.729    0.970
##
## Regressions:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   opend4 ~
##     opend3            1.001      NA                          NA       NA
##   opend3 ~
##     opend2            1.000      NA                          NA       NA
##   opend2 ~
##     opend1            1.440      NA                          NA       NA
##     Std.lv  Std.all
##
##     1.000    1.000
##
##     1.000    1.000
##
##     0.982    0.982
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .opendW1S1 ~~
##     .opendW2S1        0.047      NA                          NA       NA
##     .opendW3S1        0.065      NA                          NA       NA
##     .opendW4S1        0.027      NA                          NA       NA
##   .opendW2S1 ~~
##     .opendW3S1        0.023      NA                          NA       NA
##     .opendW4S1        0.077      NA                          NA       NA
##   .opendW3S1 ~~
##     .opendW4S1        0.021      NA                          NA       NA
##   .opendW1S2 ~~
##     .opendW2S2        0.053      NA                          NA       NA
##     .opendW3S2        0.027      NA                          NA       NA
##     .opendW4S2        0.056      NA                          NA       NA
##   .opendW2S2 ~~
```

```
##    .opendW3S2          0.060       NA                              NA       NA
##    .opendW4S2          0.046       NA                              NA       NA
## .opendW3S2 ~~
##    .opendW4S2          0.049       NA                              NA       NA
## .opendW1P1 ~~
##    .opendW2P1          0.075       NA                              NA       NA
##    .opendW3P1          0.110       NA                              NA       NA
##    .opendW4P1          0.076       NA                              NA       NA
## .opendW2P1 ~~
##    .opendW3P1          0.185       NA                              NA       NA
##    .opendW4P1          0.231       NA                              NA       NA
## .opendW3P1 ~~
##    .opendW4P1          0.093       NA                              NA       NA
## .opendW1P2 ~~
##    .opendW2P2          0.278       NA                              NA       NA
##    .opendW3P2          0.278       NA                              NA       NA
##    .opendW4P2          0.308       NA                              NA       NA
## .opendW2P2 ~~
##    .opendW3P2          0.376       NA                              NA       NA
##    .opendW4P2          0.421       NA                              NA       NA
## .opendW3P2 ~~
##    .opendW4P2          0.421       NA                              NA       NA
## .opendW1S1 ~~
##    .opendW1S2          0.405       NA                              NA       NA
## .opendW1P1 ~~
##    .opendW1P2          0.354       NA                              NA       NA
## .opendW2S1 ~~
##    .opendW2S2          0.043       NA                              NA       NA
## .opendW2P1 ~~
##    .opendW2P2          0.000       NA                              NA       NA
## .opendW3S1 ~~
##    .opendW3S2          0.106       NA                              NA       NA
## .opendW3P1 ~~
##    .opendW3P2         -0.000       NA                              NA       NA
## .opendW4S1 ~~
##    .opendW4S2          0.224       NA                              NA       NA
## .opendW4P1 ~~
##    .opendW4P2          0.036       NA                              NA       NA
##    Std.lv  Std.all
##
##     0.047    0.173
##     0.065    0.217
##     0.027    0.066
##
##     0.023    0.149
##     0.077    0.363
##
##     0.021    0.091
##
##     0.053    0.225
##     0.027    0.095
##     0.056    0.152
##
##     0.060    0.386
```

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```
##     0.046    0.228
##
##     0.049    0.199
##
##     0.075    0.143
##     0.110    0.222
##     0.076    0.115
##
##     0.185    0.581
##     0.231    0.537
##
##     0.093    0.229
##
##     0.278    0.754
##     0.278    0.754
##     0.308    0.741
##
##     0.376    1.000
##     0.421    0.995
##
##     0.421    0.995
##
##     0.405    0.849
##
##     0.354    0.652
##
##     0.043    0.323
##
##     0.000    0.000
##
##     0.106    0.590
##
##    -0.000   -0.000
##
##     0.224    0.700
##
##     0.036    0.070
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .opendW1S1       1.428       NA                         NA       NA
##     .opendW1S2       1.263       NA                         NA       NA
##     .opendW1P1       0.916       NA                         NA       NA
##     .opendW1P2       1.181       NA                         NA       NA
##     .opendW2S1       0.266       NA                         NA       NA
##     .opendW2S2       0.104       NA                         NA       NA
##     .opendW2P1       0.126       NA                         NA       NA
##     .opendW2P2       0.182       NA                         NA       NA
##     .opendW3S1       0.244       NA                         NA       NA
##     .opendW3S2       0.061       NA                         NA       NA
##     .opendW3P1      -0.013       NA                         NA       NA
##     .opendW3P2       0.181       NA                         NA       NA
##     .opendW4S1       0.323       NA                         NA       NA
##     .opendW4S2       0.126       NA                         NA       NA
```

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```
##    .opendW4P1          0.031    NA                      NA      NA
##    .opendW4P2          0.141    NA                      NA      NA
##     opend1             0.000                          0.000   0.000
##    .opend2             0.000                          0.000   0.000
##    .opend3             0.000                          0.000   0.000
##    .opend4             0.000                          0.000   0.000
##    Std.lv  Std.all
##    1.428   0.690
##    1.263   0.612
##    0.916   0.410
##    1.181   0.604
##    0.266   0.093
##    0.104   0.036
##    0.126   0.041
##    0.182   0.065
##    0.244   0.085
##    0.061   0.021
##   -0.013  -0.004
##    0.181   0.065
##    0.323   0.111
##    0.126   0.043
##    0.031   0.010
##    0.141   0.050
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##
## Variances:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .opendW1S1          0.524    NA                      NA      NA
##    .opendW1S2          0.435    NA                      NA      NA
##    .opendW1P1          0.812    NA                      NA      NA
##    .opendW1P2          0.363    NA                      NA      NA
##    .opendW2S1          0.140    NA                      NA      NA
##    .opendW2S2          0.128    NA                      NA      NA
##    .opendW2P1          0.337    NA                      NA      NA
##    .opendW2P2          0.376    NA                      NA      NA
##    .opendW3S1          0.169    NA                      NA      NA
##    .opendW3S2          0.192    NA                      NA      NA
##    .opendW3P1          0.302    NA                      NA      NA
##    .opendW3P2          0.376    NA                      NA      NA
##    .opendW4S1          0.325    NA                      NA      NA
##    .opendW4S2          0.314    NA                      NA      NA
##    .opendW4P1          0.548    NA                      NA      NA
##    .opendW4P2          0.476    NA                      NA      NA
##     opend1             3.756    NA                      NA      NA
##    .opend2             0.281    NA                      NA      NA
##    .opend3            -0.000    NA                      NA      NA
##    .opend4            -0.002    NA                      NA      NA
##    Std.lv  Std.all
##    0.524   0.122
##    0.435   0.102
##    0.812   0.163
```

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```
##      0.363    0.095
##      0.140    0.017
##      0.128    0.015
##      0.337    0.036
##      0.376    0.048
##      0.169    0.021
##      0.192    0.023
##      0.302    0.033
##      0.376    0.048
##      0.325    0.039
##      0.314    0.037
##      0.548    0.057
##      0.476    0.060
##      1.000    1.000
##      0.035    0.035
##     -0.000   -0.000
##     -0.000   -0.000
```

```r
semPaths(lsmOpend, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
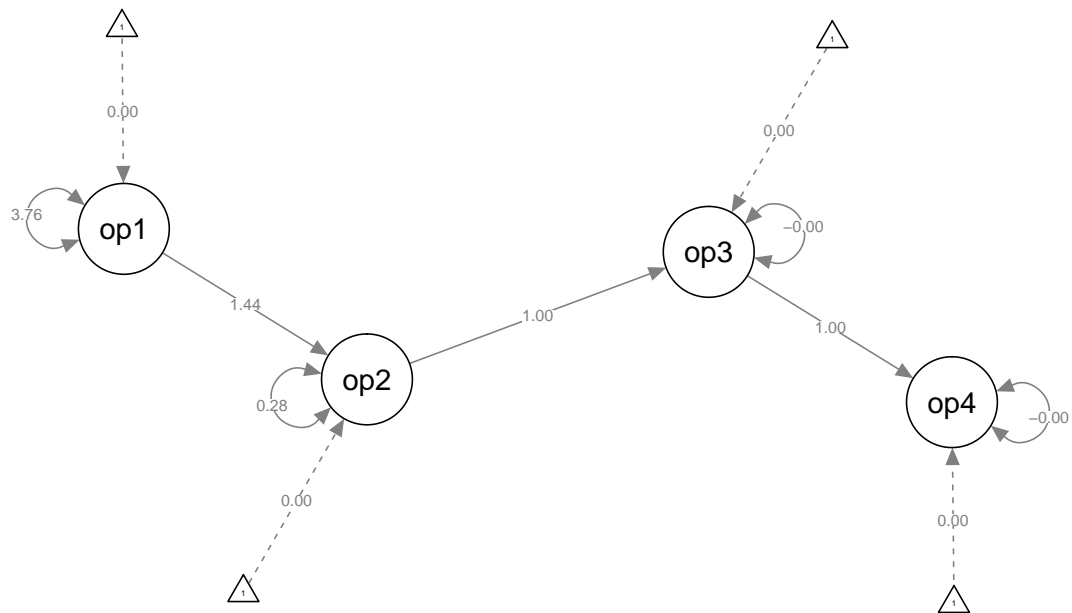

LSM Assertiveness

```r
lsmAssert <- '

# factor at each time point with same loading
assert1 =~ assertW1S1        + a * assertW1S2 +
```

```
            peer * assertW1P1 + aa * assertW1P2

assert2 =~ assertW2S1        + a * assertW2S2 +
            peer * assertW2P1 + aa * assertW2P2

assert3 =~ assertW3S1        + a * assertW3S2 +
            peer * assertW3P1 + aa * assertW3P2

assert4 =~ assertW4S1        + a * assertW4S2 +
            peer * assertW4P1 + aa * assertW4P2

# structural paths between time points
assert4 ~ assert3
assert3 ~ assert2
assert2 ~ assert1

# error covariance - similar parcels across waves
assertW1S1 ~~ assertW2S1 + assertW3S1 + assertW4S1
assertW2S1 ~~ assertW3S1 + assertW4S1
assertW3S1 ~~ assertW4S1

assertW1S2 ~~ assertW2S2 + assertW3S2 + assertW4S2
assertW2S2 ~~ assertW3S2 + assertW4S2
assertW3S2 ~~ assertW4S2

assertW1P1 ~~ assertW2P1 + assertW3P1 + assertW4P1
assertW2P1 ~~ assertW3P1 + assertW4P1
assertW3P1 ~~ assertW4P1

assertW1P2 ~~ assertW2P2 + assertW3P2 + assertW4P2
assertW2P2 ~~ assertW3P2 + assertW4P2
assertW3P2 ~~ assertW4P2

# error covariance - same method at one wave
assertW1S1 ~~ assertW1S2
assertW1P1 ~~ assertW1P2
assertW2S1 ~~ assertW2S2
assertW2P1 ~~ assertW2P2
assertW3S1 ~~ assertW3S2
assertW3P1 ~~ assertW3P2
assertW4S1 ~~ assertW4S2
assertW4P1 ~~ assertW4P2
'
lsmAssert <- sem(lsmAssert, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lsmAssert, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 172 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
```

```
##    Number of free parameters                          83
##    Number of equality constraints                       9
##
##    Number of observations                             259
##    Number of missing patterns                          52
##
## Model Test User Model:
##
##    Test statistic                                 286.637
##    Degrees of freedom                                  78
##    P-value (Chi-square)                             0.000
##
## Model Test Baseline Model:
##
##    Test statistic                                2668.403
##    Degrees of freedom                                 120
##    P-value                                          0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                      0.918
##    Tucker-Lewis Index (TLI)                         0.874
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)               -1405.842
##    Loglikelihood unrestricted model (H1)       -1262.524
##
##    Akaike (AIC)                                  2959.685
##    Bayesian (BIC)                                3222.890
##    Sample-size adjusted Bayesian (BIC)           2988.284
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                            0.102
##    90 Percent confidence interval - lower           0.089
##    90 Percent confidence interval - upper           0.114
##    P-value RMSEA <= 0.05                            0.000
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                             0.181
##
## Parameter Estimates:
##
##    Standard errors                               Standard
##    Information                                   Observed
##    Observed information based on                  Hessian
##
## Latent Variables:
##                 Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   assert1 =~
##     assW1S1             1.000                                1.000    1.000
##     assW1S2    (a)      1.069    0.068   15.789    0.000    0.936    1.202
```

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```
##     assW1P1 (peer)    0.384    0.067    5.753    0.000    0.253    0.514
##     assW1P2   (aa)    0.505    0.073    6.897    0.000    0.361    0.648
##   assert2 =~
##     assW2S1           1.000                              1.000    1.000
##     assW2S2    (a)    1.069    0.068   15.789    0.000    0.936    1.202
##     assW2P1 (peer)    0.384    0.067    5.753    0.000    0.253    0.514
##     assW2P2   (aa)    0.505    0.073    6.897    0.000    0.361    0.648
##   assert3 =~
##     assW3S1           1.000                              1.000    1.000
##     assW3S2    (a)    1.069    0.068   15.789    0.000    0.936    1.202
##     assW3P1 (peer)    0.384    0.067    5.753    0.000    0.253    0.514
##     assW3P2   (aa)    0.505    0.073    6.897    0.000    0.361    0.648
##   assert4 =~
##     assW4S1           1.000                              1.000    1.000
##     assW4S2    (a)    1.069    0.068   15.789    0.000    0.936    1.202
##     assW4P1 (peer)    0.384    0.067    5.753    0.000    0.253    0.514
##     assW4P2   (aa)    0.505    0.073    6.897    0.000    0.361    0.648
##    Std.lv  Std.all
##
##    0.570    0.828
##    0.609    0.811
##    0.219    0.375
##    0.288    0.461
##
##    0.581    0.824
##    0.621    0.848
##    0.223    0.422
##    0.293    0.476
##
##    0.594    0.863
##    0.635    0.882
##    0.228    0.406
##    0.300    0.437
##
##    0.604    0.877
##    0.645    0.895
##    0.232    0.436
##    0.305    0.480
##
## Regressions:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   assert4 ~
##     assert3          0.959    0.046   20.938    0.000    0.869    1.048
##   assert3 ~
##     assert2          0.989    0.045   21.736    0.000    0.900    1.078
##   assert2 ~
##     assert1          1.019    0.082   12.497    0.000    0.860    1.179
##    Std.lv  Std.all
##
##    0.944    0.944
##
##    0.967    0.967
##
##    1.000    1.000
```

```
## 
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .assertW1S1 ~~
##     .assertW2S1      0.045    0.021    2.115    0.034    0.003    0.086
##     .assertW3S1      0.036    0.019    1.846    0.065   -0.002    0.074
##     .assertW4S1      0.022    0.019    1.132    0.257   -0.016    0.060
##   .assertW2S1 ~~
##     .assertW3S1      0.064    0.021    3.037    0.002    0.023    0.106
##     .assertW4S1      0.056    0.021    2.686    0.007    0.015    0.097
##   .assertW3S1 ~~
##     .assertW4S1      0.059    0.020    2.889    0.004    0.019    0.099
##   .assertW1S2 ~~
##     .assertW2S2      0.069    0.024    2.880    0.004    0.022    0.115
##     .assertW3S2      0.057    0.022    2.594    0.009    0.014    0.100
##     .assertW4S2      0.052    0.022    2.323    0.020    0.008    0.096
##   .assertW2S2 ~~
##     .assertW3S2      0.053    0.023    2.361    0.018    0.009    0.098
##     .assertW4S2      0.069    0.024    2.909    0.004    0.023    0.116
##   .assertW3S2 ~~
##     .assertW4S2      0.046    0.023    2.026    0.043    0.002    0.091
##   .assertW1P1 ~~
##     .assertW2P1      0.162    0.027    5.946    0.000    0.108    0.215
##     .assertW3P1      0.173    0.032    5.477    0.000    0.111    0.234
##     .assertW4P1      0.137    0.028    4.947    0.000    0.083    0.191
##   .assertW2P1 ~~
##     .assertW3P1      0.131    0.028    4.628    0.000    0.076    0.187
##     .assertW4P1      0.137    0.026    5.232    0.000    0.085    0.188
##   .assertW3P1 ~~
##     .assertW4P1      0.163    0.031    5.201    0.000    0.101    0.224
##   .assertW1P2 ~~
##     .assertW2P2      0.172    0.032    5.357    0.000    0.109    0.235
##     .assertW3P2      0.246    0.038    6.521    0.000    0.172    0.320
##     .assertW4P2      0.210    0.034    6.260    0.000    0.144    0.276
##   .assertW2P2 ~~
##     .assertW3P2      0.270    0.040    6.793    0.000    0.192    0.348
##     .assertW4P2      0.221    0.035    6.248    0.000    0.152    0.291
##   .assertW3P2 ~~
##     .assertW4P2      0.259    0.041    6.267    0.000    0.178    0.340
##   .assertW1S1 ~~
##     .assertW1S2      0.059    0.027    2.189    0.029    0.006    0.111
##   .assertW1P1 ~~
##     .assertW1P2      0.068    0.016    4.169    0.000    0.036    0.100
##   .assertW2S1 ~~
##     .assertW2S2      0.028    0.011    2.594    0.009    0.007    0.049
##   .assertW2P1 ~~
##     .assertW2P2      0.053    0.014    3.780    0.000    0.026    0.081
##   .assertW3S1 ~~
##     .assertW3S2      0.000    0.010    0.049    0.961   -0.019    0.020
##   .assertW3P1 ~~
##     .assertW3P2     -0.004    0.017   -0.258    0.797   -0.037    0.029
##   .assertW4S1 ~~
##     .assertW4S2      0.004    0.033    0.113    0.910   -0.061    0.068
##   .assertW4P1 ~~
```

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```
##     .assertW4P2          0.039    0.015    2.543    0.011    0.009    0.069
##     Std.lv  Std.all
##
##     0.045    0.291
##     0.036    0.268
##     0.022    0.171
##
##     0.064    0.464
##     0.056    0.425
##
##     0.059    0.510
##
##     0.069    0.402
##     0.057    0.381
##     0.052    0.371
##
##     0.053    0.404
##     0.069    0.556
##
##     0.046    0.424
##
##     0.162    0.625
##     0.173    0.622
##     0.137    0.529
##
##     0.131    0.533
##     0.137    0.596
##
##     0.163    0.662
##
##     0.172    0.574
##     0.246    0.720
##     0.210    0.683
##
##     0.270    0.808
##     0.221    0.736
##
##     0.259    0.754
##
##     0.059    0.347
##
##     0.068    0.229
##
##     0.028    0.179
##
##     0.053    0.206
##
##     0.000    0.004
##
##    -0.004   -0.014
##
##     0.004    0.035
##
##     0.039    0.146
```

```
## 
## Intercepts:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .assertW1S1     3.401    0.043   79.457    0.000    3.317    3.485
##     .assertW1S2     3.521    0.047   75.385    0.000    3.430    3.613
##     .assertW1P1     3.683    0.046   80.837    0.000    3.594    3.773
##     .assertW1P2     3.496    0.048   72.989    0.000    3.402    3.590
##     .assertW2S1     3.348    0.046   72.372    0.000    3.257    3.439
##     .assertW2S2     3.479    0.048   72.923    0.000    3.386    3.573
##     .assertW2P1     3.751    0.042   88.665    0.000    3.668    3.833
##     .assertW2P2     3.560    0.048   74.565    0.000    3.467    3.654
##     .assertW3S1     3.336    0.045   73.518    0.000    3.247    3.425
##     .assertW3S2     3.474    0.047   73.572    0.000    3.381    3.566
##     .assertW3P1     3.671    0.046   79.553    0.000    3.581    3.762
##     .assertW3P2     3.537    0.054   66.004    0.000    3.432    3.642
##     .assertW4S1     3.391    0.048   70.829    0.000    3.297    3.485
##     .assertW4S2     3.508    0.050   70.782    0.000    3.410    3.605
##     .assertW4P1     3.664    0.047   78.318    0.000    3.572    3.755
##     .assertW4P2     3.551    0.053   67.028    0.000    3.447    3.654
##      assert1        0.000                               0.000    0.000
##     .assert2        0.000                               0.000    0.000
##     .assert3        0.000                               0.000    0.000
##     .assert4        0.000                               0.000    0.000
##    Std.lv  Std.all
##     3.401    4.940
##     3.521    4.687
##     3.683    6.319
##     3.496    5.606
##     3.348    4.751
##     3.479    4.750
##     3.751    7.097
##     3.560    5.786
##     3.336    4.845
##     3.474    4.821
##     3.671    6.534
##     3.537    5.153
##     3.391    4.926
##     3.508    4.866
##     3.664    6.894
##     3.551    5.600
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
## 
## Variances:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .assertW1S1     0.149    0.031    4.821    0.000    0.088    0.210
##     .assertW1S2     0.193    0.040    4.817    0.000    0.115    0.272
##     .assertW1P1     0.292    0.034    8.582    0.000    0.225    0.359
##     .assertW1P2     0.306    0.036    8.567    0.000    0.236    0.376
##     .assertW2S1     0.159    0.027    5.882    0.000    0.106    0.212
##     .assertW2S2     0.151    0.029    5.290    0.000    0.095    0.207
##     .assertW2P1     0.230    0.029    8.049    0.000    0.174    0.286
```

```
##     .assertW2P2        0.293    0.036    8.021    0.000    0.221    0.364
##     .assertW3S1        0.121    0.024    4.998    0.000    0.074    0.168
##     .assertW3S2        0.116    0.027    4.350    0.000    0.063    0.168
##     .assertW3P1        0.264    0.037    7.216    0.000    0.192    0.335
##     .assertW3P2        0.381    0.051    7.503    0.000    0.282    0.481
##     .assertW4S1        0.109    0.039    2.806    0.005    0.033    0.186
##     .assertW4S2        0.103    0.044    2.337    0.019    0.017    0.189
##     .assertW4P1        0.229    0.032    7.042    0.000    0.165    0.292
##     .assertW4P2        0.309    0.044    6.989    0.000    0.223    0.396
##      assert1           0.325    0.045    7.165    0.000    0.236    0.414
##     .assert2          -0.000    0.025   -0.003    0.998   -0.049    0.049
##     .assert3           0.023    0.011    2.176    0.030    0.002    0.044
##     .assert4           0.040    0.031    1.295    0.195   -0.020    0.100
##    Std.lv  Std.all
##     0.149    0.315
##     0.193    0.342
##     0.292    0.859
##     0.306    0.787
##     0.159    0.320
##     0.151    0.281
##     0.230    0.822
##     0.293    0.773
##     0.121    0.255
##     0.116    0.223
##     0.264    0.835
##     0.381    0.809
##     0.109    0.231
##     0.103    0.198
##     0.229    0.810
##     0.309    0.769
##     1.000    1.000
##    -0.000   -0.000
##     0.066    0.066
##     0.109    0.109
```

```r
semPaths(lsmAssert, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
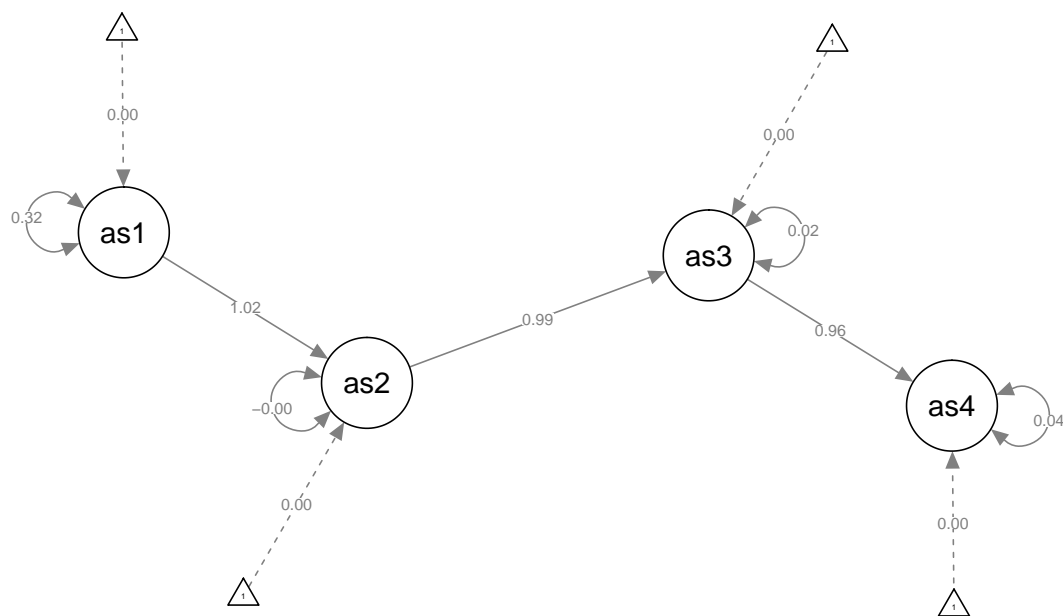
LSM Compassion

```
lsmCompa <- '

# factor at each time point with same loading
compa1 =~ compaW1S1       + a * compaW1S2 +
          peer * compaW1P1 + aa * compaW1P2

compa2 =~ compaW2S1       + a * compaW2S2 +
          peer * compaW2P1 + aa * compaW2P2

compa3 =~ compaW3S1       + a * compaW3S2 +
          peer * compaW3P1 + aa * compaW3P2

compa4 =~ compaW4S1       + a * compaW4S2 +
          peer * compaW4P1 + aa * compaW4P2

# structural paths between time points
compa4 ~ compa3
compa3 ~ compa2
compa2 ~ compa1

# error covariance - similar parcels across waves
compaW1S1 ~~ compaW2S1 + compaW3S1 + compaW4S1
compaW2S1 ~~ compaW3S1 + compaW4S1
```

```
compaW3S1 ~~ compaW4S1

compaW1S2 ~~ compaW2S2 + compaW3S2 + compaW4S2
compaW2S2 ~~ compaW3S2 + compaW4S2
compaW3S2 ~~ compaW4S2

compaW1P1 ~~ compaW2P1 + compaW3P1 + compaW4P1
compaW2P1 ~~ compaW3P1 + compaW4P1
compaW3P1 ~~ compaW4P1

compaW1P2 ~~ compaW2P2 + compaW3P2 + compaW4P2
compaW2P2 ~~ compaW3P2 + compaW4P2
compaW3P2 ~~ compaW4P2

# error covariance - same method at one wave
compaW1S1 ~~ compaW1S2
compaW1P1 ~~ compaW1P2
compaW2S1 ~~ compaW2S2
compaW2P1 ~~ compaW2P2
compaW3S1 ~~ compaW3S2
compaW3P1 ~~ compaW3P2
compaW4S1 ~~ compaW4S2
compaW4P1 ~~ compaW4P2
'
lsmCompa <- sem(lsmCompa, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lsmCompa, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 204 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               314.754
##   Degrees of freedom                                78
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2272.548
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
```

```
##
##   Comparative Fit Index (CFI)                        0.890
##   Tucker-Lewis Index (TLI)                           0.831
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)               -1044.836
##   Loglikelihood unrestricted model (H1)        -887.459
##
##   Akaike (AIC)                                2237.671
##   Bayesian (BIC)                              2500.876
##   Sample-size adjusted Bayesian (BIC)         2266.270
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.108
##   90 Percent confidence interval - lower         0.096
##   90 Percent confidence interval - upper         0.121
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.202
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   compa1 =~
##     cmpW1S1           1.000                                     1.000    1.000
##     cmpW1S2    (a)    1.076    0.059   18.321    0.000    0.961    1.191
##     cmpW1P1 (peer)    0.685    0.123    5.592    0.000    0.445    0.925
##     cmpW1P2   (aa)    0.674    0.122    5.535    0.000    0.435    0.913
##   compa2 =~
##     cmpW2S1           1.000                                     1.000    1.000
##     cmpW2S2    (a)    1.076    0.059   18.321    0.000    0.961    1.191
##     cmpW2P1 (peer)    0.685    0.123    5.592    0.000    0.445    0.925
##     cmpW2P2   (aa)    0.674    0.122    5.535    0.000    0.435    0.913
##   compa3 =~
##     cmpW3S1           1.000                                     1.000    1.000
##     cmpW3S2    (a)    1.076    0.059   18.321    0.000    0.961    1.191
##     cmpW3P1 (peer)    0.685    0.123    5.592    0.000    0.445    0.925
##     cmpW3P2   (aa)    0.674    0.122    5.535    0.000    0.435    0.913
##   compa4 =~
##     cmpW4S1           1.000                                     1.000    1.000
##     cmpW4S2    (a)    1.076    0.059   18.321    0.000    0.961    1.191
##     cmpW4P1 (peer)    0.685    0.123    5.592    0.000    0.445    0.925
##     cmpW4P2   (aa)    0.674    0.122    5.535    0.000    0.435    0.913
##    Std.lv  Std.all
##
```

```
##    0.269    0.551
##    0.289    0.551
##    0.184    0.304
##    0.181    0.336
##
##    0.389    0.784
##    0.418    0.779
##    0.266    0.488
##    0.262    0.447
##
##    0.395    0.797
##    0.425    0.810
##    0.271    0.471
##    0.266    0.515
##
##    0.346    0.705
##    0.372    0.702
##    0.237    0.403
##    0.233    0.394
##
## Regressions:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   compa4 ~
##     compa3           1.091    0.063   17.222    0.000    0.966    1.215
##   compa3 ~
##     compa2           0.965    0.076   12.643    0.000    0.816    1.115
##   compa2 ~
##     compa1           1.761    0.557    3.163    0.002    0.670    2.852
##    Std.lv  Std.all
##
##     1.245    1.245
##
##     0.950    0.950
##
##     1.216    1.216
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##  .compaW1S1 ~~
##     .compaW2S1      -0.006    0.009   -0.637    0.524   -0.023    0.012
##     .compaW3S1       0.005    0.008    0.621    0.535   -0.011    0.022
##     .compaW4S1       0.007    0.008    0.830    0.406   -0.009    0.023
##  .compaW2S1 ~~
##     .compaW3S1       0.023    0.009    2.458    0.014    0.005    0.041
##     .compaW4S1       0.016    0.009    1.798    0.072   -0.001    0.033
##  .compaW3S1 ~~
##     .compaW4S1       0.018    0.009    2.082    0.037    0.001    0.035
##  .compaW1S2 ~~
##     .compaW2S2       0.022    0.010    2.155    0.031    0.002    0.043
##     .compaW3S2       0.012    0.009    1.370    0.171   -0.005    0.030
##     .compaW4S2      -0.004    0.009   -0.452    0.651   -0.022    0.014
##  .compaW2S2 ~~
##     .compaW3S2       0.034    0.010    3.331    0.001    0.014    0.054
##     .compaW4S2       0.025    0.010    2.549    0.011    0.006    0.044
```

```
##   .compaW3S2 ~~
##     .compaW4S2          0.019    0.009    2.040    0.041    0.001    0.037
## .compaW1P1 ~~
##     .compaW2P1         -0.001    0.015   -0.065    0.949   -0.031    0.029
##     .compaW3P1          0.001    0.021    0.034    0.973   -0.040    0.041
##     .compaW4P1          0.014    0.016    0.871    0.384   -0.018    0.046
## .compaW2P1 ~~
##     .compaW3P1          0.033    0.016    2.061    0.039    0.002    0.065
##     .compaW4P1          0.036    0.015    2.446    0.014    0.007    0.065
## .compaW3P1 ~~
##     .compaW4P1          0.007    0.022    0.335    0.737   -0.035    0.049
## .compaW1P2 ~~
##     .compaW2P2          0.033    0.015    2.226    0.026    0.004    0.062
##     .compaW3P2          0.047    0.014    3.326    0.001    0.019    0.074
##     .compaW4P2          0.020    0.017    1.198    0.231   -0.013    0.053
## .compaW2P2 ~~
##     .compaW3P2          0.001    0.015    0.085    0.932   -0.028    0.031
##     .compaW4P2         -0.014    0.017   -0.859    0.390   -0.047    0.018
## .compaW3P2 ~~
##     .compaW4P2          0.037    0.015    2.471    0.013    0.008    0.066
## .compaW1S1 ~~
##     .compaW1S2          0.114    0.028    4.128    0.000    0.060    0.169
## .compaW1P1 ~~
##     .compaW1P2          0.213    0.035    6.155    0.000    0.145    0.281
## .compaW2S1 ~~
##     .compaW2S2          0.031    0.011    2.859    0.004    0.010    0.052
## .compaW2P1 ~~
##     .compaW2P2          0.199    0.032    6.198    0.000    0.136    0.262
## .compaW3S1 ~~
##     .compaW3S2          0.027    0.009    3.083    0.002    0.010    0.044
## .compaW3P1 ~~
##     .compaW3P2          0.147    0.032    4.524    0.000    0.083    0.210
## .compaW4S1 ~~
##     .compaW4S2          0.093    0.030    3.155    0.002    0.035    0.151
## .compaW4P1 ~~
##     .compaW4P2          0.252    0.045    5.622    0.000    0.164    0.339
##    Std.lv  Std.all
##
##   -0.006   -0.045
##    0.005    0.043
##    0.007    0.049
##
##    0.023    0.248
##    0.016    0.146
##
##    0.018    0.173
##
##    0.022    0.152
##    0.012    0.092
##   -0.004   -0.025
##
##    0.034    0.327
##    0.025    0.196
##
```

```
##    0.019    0.162
##
##   -0.001   -0.004
##    0.001    0.002
##    0.014    0.045
##
##    0.033    0.137
##    0.036    0.142
##
##    0.007    0.026
##
##    0.033    0.124
##    0.047    0.208
##    0.020    0.073
##
##    0.001    0.006
##   -0.014   -0.050
##
##    0.037    0.153
##
##    0.114    0.643
##
##    0.213    0.729
##
##    0.031    0.295
##
##    0.199    0.795
##
##    0.027    0.295
##
##    0.147    0.652
##
##    0.093    0.708
##
##    0.252    0.860
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .compaW1S1        4.197    0.030  138.342    0.000    4.138    4.257
##     .compaW1S2        4.095    0.033  125.587    0.000    4.031    4.159
##     .compaW1P1        3.945    0.049   79.933    0.000    3.849    4.042
##     .compaW1P2        3.972    0.043   91.339    0.000    3.887    4.057
##     .compaW2S1        4.182    0.034  123.841    0.000    4.115    4.248
##     .compaW2S2        4.084    0.036  112.558    0.000    4.013    4.156
##     .compaW2P1        3.982    0.046   87.339    0.000    3.893    4.072
##     .compaW2P2        4.026    0.050   81.180    0.000    3.929    4.123
##     .compaW3S1        4.206    0.034  123.996    0.000    4.139    4.272
##     .compaW3S2        4.067    0.036  113.728    0.000    3.997    4.137
##     .compaW3P1        3.982    0.051   78.282    0.000    3.883    4.082
##     .compaW3P2        4.023    0.045   89.976    0.000    3.936    4.111
##     .compaW4S1        4.237    0.035  121.782    0.000    4.169    4.305
##     .compaW4S2        4.163    0.038  110.427    0.000    4.089    4.237
##     .compaW4P1        3.840    0.056   68.271    0.000    3.730    3.950
##     .compaW4P2        3.950    0.057   69.830    0.000    3.839    4.061
```

```
##     compa1              0.000                                0.000   0.000
##    .compa2              0.000                                0.000   0.000
##    .compa3              0.000                                0.000   0.000
##    .compa4              0.000                                0.000   0.000
##    Std.lv  Std.all
##     4.197    8.606
##     4.095    7.812
##     3.945    6.523
##     3.972    7.370
##     4.182    8.435
##     4.084    7.601
##     3.982    7.296
##     4.026    6.862
##     4.206    8.485
##     4.067    7.745
##     3.982    6.922
##     4.023    7.782
##     4.237    8.625
##     4.163    7.847
##     3.840    6.529
##     3.950    6.675
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .compaW1S1          0.166    0.028    5.853    0.000    0.110    0.221
##    .compaW1S2          0.191    0.030    6.359    0.000    0.132    0.250
##    .compaW1P1          0.332    0.044    7.578    0.000    0.246    0.418
##    .compaW1P2          0.258    0.030    8.455    0.000    0.198    0.317
##    .compaW2S1          0.095    0.015    6.203    0.000    0.065    0.124
##    .compaW2S2          0.114    0.017    6.780    0.000    0.081    0.147
##    .compaW2P1          0.227    0.031    7.361    0.000    0.166    0.287
##    .compaW2P2          0.276    0.038    7.265    0.000    0.201    0.350
##    .compaW3S1          0.089    0.014    6.514    0.000    0.063    0.116
##    .compaW3S2          0.095    0.014    6.808    0.000    0.068    0.122
##    .compaW3P1          0.258    0.039    6.601    0.000    0.181    0.334
##    .compaW3P2          0.196    0.028    6.972    0.000    0.141    0.252
##    .compaW4S1          0.121    0.028    4.302    0.000    0.066    0.177
##    .compaW4S2          0.143    0.033    4.297    0.000    0.078    0.208
##    .compaW4P1          0.290    0.047    6.152    0.000    0.197    0.382
##    .compaW4P2          0.296    0.045    6.508    0.000    0.207    0.385
##     compa1             0.072    0.026    2.749    0.006    0.021    0.124
##    .compa2            -0.072    0.068   -1.059    0.290   -0.206    0.062
##    .compa3             0.015    0.010    1.583    0.114   -0.004    0.034
##    .compa4            -0.066    0.025   -2.591    0.010   -0.116   -0.016
##    Std.lv  Std.all
##     0.166    0.697
##     0.191    0.696
##     0.332    0.907
##     0.258    0.887
##     0.095    0.385
```
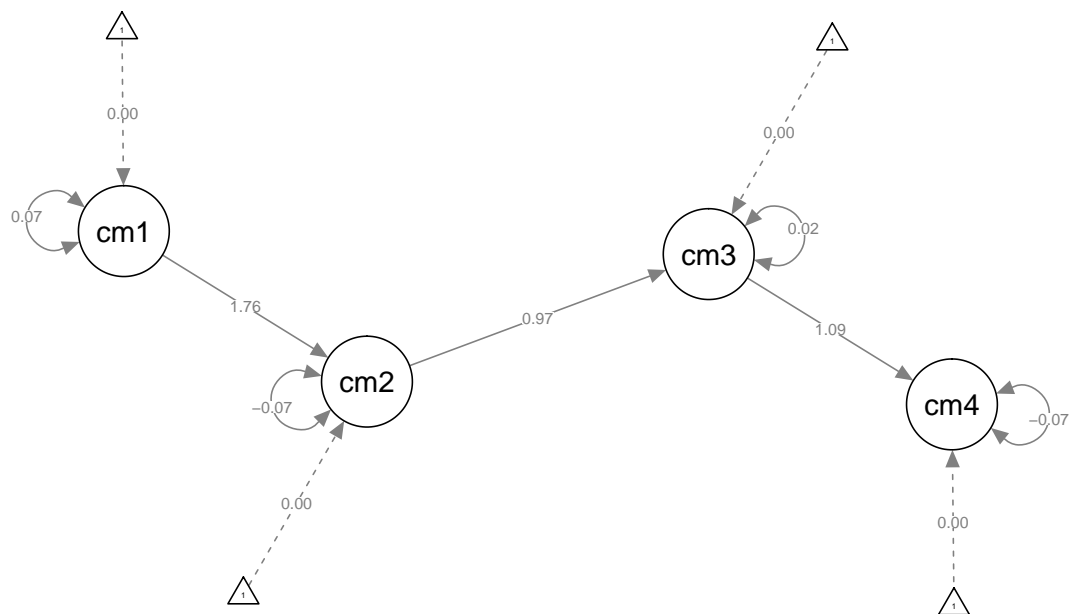
```
##      0.114    0.394
##      0.227    0.762
##      0.276    0.800
##      0.089    0.364
##      0.095    0.344
##      0.258    0.778
##      0.196    0.735
##      0.121    0.503
##      0.143    0.507
##      0.290    0.837
##      0.296    0.845
##      1.000    1.000
##     -0.479   -0.479
##      0.098    0.098
##     -0.551   -0.551
```

```r
semPaths(lsmCompa, what = "col", whatLabels = "est", structural = T, layout = "spring")
```


LSM Enthusiasm

```r
lsmEnthu <- '

# factor at each time point with same loading
enthu1 =~ enthuW1S1        + a * enthuW1S2 +
          peer * enthuW1P1 + aa * enthuW1P2

```

```
enthu2 =~ enthuW2S1         + a * enthuW2S2 +
          peer * enthuW2P1 + aa * enthuW2P2

enthu3 =~ enthuW3S1         + a * enthuW3S2 +
          peer * enthuW3P1 + aa * enthuW3P2

enthu4 =~ enthuW4S1         + a * enthuW4S2 +
          peer * enthuW4P1 + aa * enthuW4P2

# structural paths between time points
enthu4 ~ enthu3
enthu3 ~ enthu2
enthu2 ~ enthu1

# error covariance - similar parcels across waves
enthuW1S1 ~~ enthuW2S1 + enthuW3S1 + enthuW4S1
enthuW2S1 ~~ enthuW3S1 + enthuW4S1
enthuW3S1 ~~ enthuW4S1

enthuW1S2 ~~ enthuW2S2 + enthuW3S2 + enthuW4S2
enthuW2S2 ~~ enthuW3S2 + enthuW4S2
enthuW3S2 ~~ enthuW4S2

enthuW1P1 ~~ enthuW2P1 + enthuW3P1 + enthuW4P1
enthuW2P1 ~~ enthuW3P1 + enthuW4P1
enthuW3P1 ~~ enthuW4P1

enthuW1P2 ~~ enthuW2P2 + enthuW3P2 + enthuW4P2
enthuW2P2 ~~ enthuW3P2 + enthuW4P2
enthuW3P2 ~~ enthuW4P2

# error covariance - same method at one wave
enthuW1S1 ~~ enthuW1S2
enthuW1P1 ~~ enthuW1P2
enthuW2S1 ~~ enthuW2S2
enthuW2P1 ~~ enthuW2P2
enthuW3S1 ~~ enthuW3S2
enthuW3P1 ~~ enthuW3P2
enthuW4S1 ~~ enthuW4S2
enthuW4P1 ~~ enthuW4P2
'
lsmEnthu <- sem(lsmEnthu, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lsmEnthu, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 165 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
```

```
##
##    Number of observations                       259
##    Number of missing patterns                    52
##
## Model Test User Model:
##
##    Test statistic                           239.458
##    Degrees of freedom                            78
##    P-value (Chi-square)                       0.000
##
## Model Test Baseline Model:
##
##    Test statistic                          2328.338
##    Degrees of freedom                           120
##    P-value                                    0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                0.927
##    Tucker-Lewis Index (TLI)                   0.888
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)          -1510.599
##    Loglikelihood unrestricted model (H1)  -1390.870
##
##    Akaike (AIC)                            3169.198
##    Bayesian (BIC)                          3432.404
##    Sample-size adjusted Bayesian (BIC)     3197.797
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                      0.089
##    90 Percent confidence interval - lower     0.077
##    90 Percent confidence interval - upper     0.102
##    P-value RMSEA <= 0.05                      0.000
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                       0.148
##
## Parameter Estimates:
##
##    Standard errors                         Standard
##    Information                             Observed
##    Observed information based on            Hessian
##
## Latent Variables:
##                 Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    enthu1 =~
##      entW1S1            1.000                                1.000    1.000
##      entW1S2    (a)     1.176    0.090   13.061    0.000    1.000    1.353
##      entW1P1 (peer)     0.832    0.181    4.590    0.000    0.477    1.188
##      entW1P2   (aa)     0.701    0.162    4.329    0.000    0.384    1.019
```

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```
##   enthu2 =~
##     entW2S1                1.000                                1.000    1.000
##     entW2S2    (a)         1.176    0.090   13.061   0.000      1.000    1.353
##     entW2P1 (peer)         0.832    0.181    4.590   0.000      0.477    1.188
##     entW2P2   (aa)         0.701    0.162    4.329   0.000      0.384    1.019
##   enthu3 =~
##     entW3S1                1.000                                1.000    1.000
##     entW3S2    (a)         1.176    0.090   13.061   0.000      1.000    1.353
##     entW3P1 (peer)         0.832    0.181    4.590   0.000      0.477    1.188
##     entW3P2   (aa)         0.701    0.162    4.329   0.000      0.384    1.019
##   enthu4 =~
##     entW4S1                1.000                                1.000    1.000
##     entW4S2    (a)         1.176    0.090   13.061   0.000      1.000    1.353
##     entW4P1 (peer)         0.832    0.181    4.590   0.000      0.477    1.188
##     entW4P2   (aa)         0.701    0.162    4.329   0.000      0.384    1.019
##    Std.lv  Std.all
##
##    0.466    0.708
##    0.548    0.738
##    0.388    0.604
##    0.327    0.562
##
##    0.484    0.755
##    0.570    0.771
##    0.403    0.631
##    0.340    0.600
##
##    0.448    0.729
##    0.527    0.721
##    0.373    0.626
##    0.314    0.580
##
##    0.423    0.697
##    0.498    0.681
##    0.352    0.597
##    0.297    0.530
##
## Regressions:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   enthu4 ~
##     enthu3           0.995    0.063   15.671   0.000     0.870    1.119
##   enthu3 ~
##     enthu2           0.900    0.055   16.374   0.000     0.792    1.007
##   enthu2 ~
##     enthu1           1.042    0.086   12.138   0.000     0.874    1.210
##    Std.lv  Std.all
##
##    1.052    1.052
##
##    0.974    0.974
##
##    1.002    1.002
##
## Covariances:
```

```
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .enthuW1S1 ~~
##     .enthuW2S1        0.096    0.022    4.318    0.000    0.052    0.139
##     .enthuW3S1        0.085    0.023    3.739    0.000    0.040    0.129
##     .enthuW4S1        0.068    0.022    3.156    0.002    0.026    0.111
##   .enthuW2S1 ~~
##     .enthuW3S1        0.066    0.026    2.500    0.012    0.014    0.118
##     .enthuW4S1        0.084    0.027    3.161    0.002    0.032    0.136
##   .enthuW3S1 ~~
##     .enthuW4S1        0.080    0.028    2.869    0.004    0.025    0.134
##   .enthuW1S2 ~~
##     .enthuW2S2        0.087    0.032    2.726    0.006    0.024    0.149
##     .enthuW3S2        0.070    0.031    2.271    0.023    0.010    0.131
##     .enthuW4S2        0.081    0.032    2.555    0.011    0.019    0.143
##   .enthuW2S2 ~~
##     .enthuW3S2        0.131    0.035    3.755    0.000    0.062    0.199
##     .enthuW4S2        0.130    0.035    3.694    0.000    0.061    0.200
##   .enthuW3S2 ~~
##     .enthuW4S2        0.152    0.037    4.124    0.000    0.080    0.224
##   .enthuW1P1 ~~
##     .enthuW2P1        0.135    0.045    2.989    0.003    0.046    0.224
##     .enthuW3P1        0.126    0.043    2.952    0.003    0.042    0.209
##     .enthuW4P1        0.108    0.039    2.769    0.006    0.032    0.184
##   .enthuW2P1 ~~
##     .enthuW3P1        0.147    0.043    3.403    0.001    0.062    0.231
##     .enthuW4P1        0.100    0.042    2.402    0.016    0.018    0.182
##   .enthuW3P1 ~~
##     .enthuW4P1        0.106    0.041    2.608    0.009    0.026    0.186
##   .enthuW1P2 ~~
##     .enthuW2P2        0.122    0.038    3.214    0.001    0.048    0.196
##     .enthuW3P2        0.126    0.035    3.632    0.000    0.058    0.194
##     .enthuW4P2        0.091    0.033    2.709    0.007    0.025    0.156
##   .enthuW2P2 ~~
##     .enthuW3P2        0.113    0.035    3.176    0.001    0.043    0.182
##     .enthuW4P2        0.090    0.034    2.671    0.008    0.024    0.156
##   .enthuW3P2 ~~
##     .enthuW4P2        0.102    0.034    3.025    0.002    0.036    0.168
##   .enthuW1S1 ~~
##     .enthuW1S2        0.074    0.024    3.148    0.002    0.028    0.120
##   .enthuW1P1 ~~
##     .enthuW1P2        0.066    0.019    3.399    0.001    0.028    0.104
##   .enthuW2S1 ~~
##     .enthuW2S2        0.028    0.012    2.335    0.020    0.005    0.052
##   .enthuW2P1 ~~
##     .enthuW2P2        0.045    0.017    2.714    0.007    0.012    0.077
##   .enthuW3S1 ~~
##     .enthuW3S2        0.035    0.013    2.639    0.008    0.009    0.060
##   .enthuW3P1 ~~
##     .enthuW3P2        0.041    0.015    2.717    0.007    0.011    0.070
##   .enthuW4S1 ~~
##     .enthuW4S2        0.069    0.024    2.832    0.005    0.021    0.117
##   .enthuW4P1 ~~
##     .enthuW4P2        0.088    0.028    3.132    0.002    0.033    0.143
##    Std.lv  Std.all
```

```
##
##      0.096    0.489
##      0.085    0.433
##      0.068    0.337
##
##      0.066    0.373
##      0.084    0.458
##
##      0.080    0.436
##
##      0.087    0.369
##      0.070    0.277
##      0.081    0.302
##
##      0.131    0.548
##      0.130    0.518
##
##      0.152    0.561
##
##      0.135    0.534
##      0.126    0.530
##      0.108    0.446
##
##      0.147    0.637
##      0.100    0.428
##
##      0.106    0.483
##
##      0.122    0.559
##      0.126    0.594
##      0.091    0.397
##
##      0.113    0.563
##      0.090    0.418
##
##      0.102    0.486
##
##      0.074    0.318
##
##      0.066    0.269
##
##      0.028    0.143
##
##      0.045    0.199
##
##      0.035    0.163
##
##      0.041    0.200
##
##      0.069    0.296
##
##      0.088    0.389
##
## Intercepts:
```

```
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      .enthuW1S1        3.922    0.041   95.861    0.000    3.842    4.002
##      .enthuW1S2        3.535    0.046   76.599    0.000    3.445    3.626
##      .enthuW1P1        3.688    0.049   75.553    0.000    3.592    3.784
##      .enthuW1P2        3.942    0.045   88.483    0.000    3.855    4.029
##      .enthuW2S1        3.848    0.042   90.970    0.000    3.765    3.931
##      .enthuW2S2        3.544    0.049   72.512    0.000    3.449    3.640
##      .enthuW2P1        3.669    0.049   74.434    0.000    3.572    3.765
##      .enthuW2P2        3.976    0.044   89.683    0.000    3.889    4.063
##      .enthuW3S1        3.841    0.041   93.434    0.000    3.761    3.922
##      .enthuW3S2        3.504    0.049   71.168    0.000    3.408    3.601
##      .enthuW3P1        3.736    0.047   79.374    0.000    3.643    3.828
##      .enthuW3P2        3.961    0.043   91.199    0.000    3.876    4.046
##      .enthuW4S1        3.902    0.043   90.499    0.000    3.817    3.986
##      .enthuW4S2        3.539    0.051   68.765    0.000    3.438    3.639
##      .enthuW4P1        3.694    0.052   71.735    0.000    3.594    3.795
##      .enthuW4P2        3.917    0.050   77.838    0.000    3.818    4.015
##       enthu1           0.000                               0.000    0.000
##      .enthu2           0.000                               0.000    0.000
##      .enthu3           0.000                               0.000    0.000
##      .enthu4           0.000                               0.000    0.000
##    Std.lv  Std.all
##    3.922    5.961
##    3.535    4.764
##    3.688    5.753
##    3.942    6.784
##    3.848    5.996
##    3.544    4.796
##    3.669    5.745
##    3.976    7.017
##    3.841    6.255
##    3.504    4.796
##    3.736    6.275
##    3.961    7.315
##    3.902    6.420
##    3.539    4.841
##    3.694    6.258
##    3.917    6.989
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##    0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      .enthuW1S1        0.216    0.029    7.406    0.000    0.159    0.273
##      .enthuW1S2        0.251    0.047    5.385    0.000    0.159    0.342
##      .enthuW1P1        0.261    0.046    5.699    0.000    0.171    0.351
##      .enthuW1P2        0.231    0.038    6.142    0.000    0.157    0.305
##      .enthuW2S1        0.177    0.031    5.646    0.000    0.116    0.239
##      .enthuW2S2        0.222    0.042    5.330    0.000    0.140    0.303
##      .enthuW2P1        0.245    0.048    5.059    0.000    0.150    0.340
##      .enthuW2P2        0.206    0.040    5.083    0.000    0.126    0.285
##      .enthuW3S1        0.177    0.033    5.329    0.000    0.112    0.242
```

```
##    .enthuW3S2         0.257    0.041    6.188    0.000    0.175    0.338
##    .enthuW3P1         0.216    0.042    5.134    0.000    0.133    0.298
##    .enthuW3P2         0.195    0.033    5.983    0.000    0.131    0.258
##    .enthuW4S1         0.190    0.035    5.469    0.000    0.122    0.258
##    .enthuW4S2         0.286    0.047    6.092    0.000    0.194    0.378
##    .enthuW4P1         0.224    0.036    6.163    0.000    0.153    0.296
##    .enthuW4P2         0.226    0.036    6.200    0.000    0.154    0.297
##     enthu1            0.217    0.041    5.286    0.000    0.136    0.297
##    .enthu2           -0.001    0.018   -0.044    0.965   -0.036    0.034
##    .enthu3            0.010    0.010    1.076    0.282   -0.009    0.029
##    .enthu4           -0.019    0.017   -1.102    0.270   -0.053    0.015
##    Std.lv  Std.all
##     0.216    0.499
##     0.251    0.455
##     0.261    0.635
##     0.231    0.684
##     0.177    0.430
##     0.222    0.406
##     0.245    0.602
##     0.206    0.641
##     0.177    0.469
##     0.257    0.481
##     0.216    0.608
##     0.195    0.664
##     0.190    0.515
##     0.286    0.536
##     0.224    0.644
##     0.226    0.719
##     1.000    1.000
##    -0.003   -0.003
##     0.052    0.052
##    -0.106   -0.106
```

```r
semPaths(lsmEnthu, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
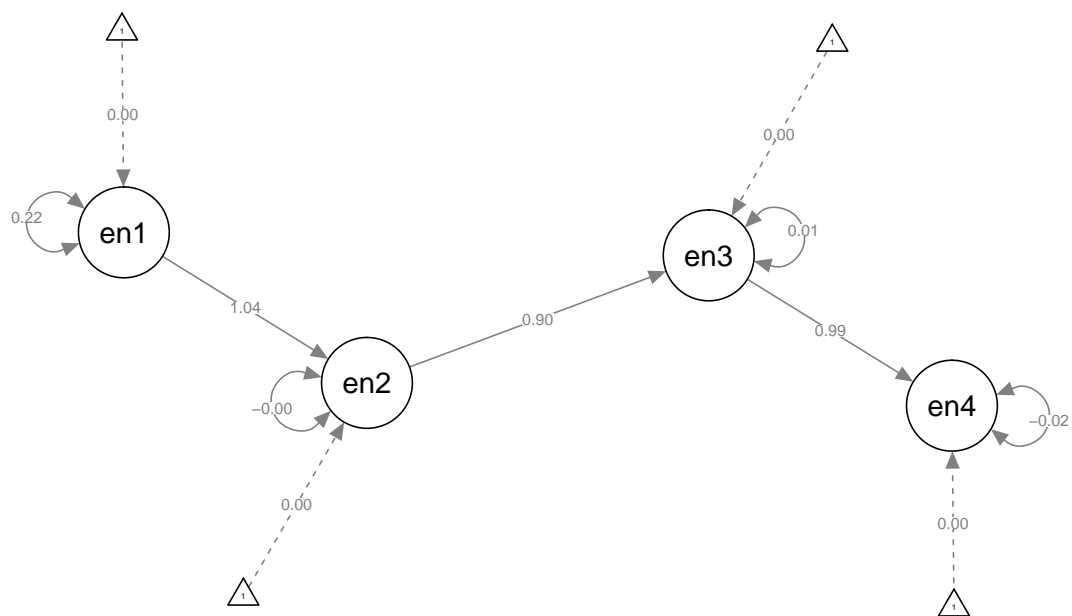
LSM Industriousness

```
lsmIndus <- '

# factor at each time point with same loading
indus1 =~ indusW1S1        + a * indusW1S2 +
          peer * indusW1P1 + aa * indusW1P2

indus2 =~ indusW2S1        + a * indusW2S2 +
          peer * indusW2P1 + aa * indusW2P2

indus3 =~ indusW3S1        + a * indusW3S2 +
          peer * indusW3P1 + aa * indusW3P2

indus4 =~ indusW4S1        + a * indusW4S2 +
          peer * indusW4P1 + aa * indusW4P2

# structural paths between time points
indus4 ~ indus3
indus3 ~ indus2
indus2 ~ indus1

# error covariance - similar parcels across waves
indusW1S1 ~~ indusW2S1 + indusW3S1 + indusW4S1
indusW2S1 ~~ indusW3S1 + indusW4S1
```

```
indusW3S1 ~~ indusW4S1

indusW1S2 ~~ indusW2S2 + indusW3S2 + indusW4S2
indusW2S2 ~~ indusW3S2 + indusW4S2
indusW3S2 ~~ indusW4S2

indusW1P1 ~~ indusW2P1 + indusW3P1 + indusW4P1
indusW2P1 ~~ indusW3P1 + indusW4P1
indusW3P1 ~~ indusW4P1

indusW1P2 ~~ indusW2P2 + indusW3P2 + indusW4P2
indusW2P2 ~~ indusW3P2 + indusW4P2
indusW3P2 ~~ indusW4P2

# error covariance - same method at one wave
indusW1S1 ~~ indusW1S2
indusW1P1 ~~ indusW1P2
indusW2S1 ~~ indusW2S2
indusW2P1 ~~ indusW2P2
indusW3S1 ~~ indusW3S2
indusW3P1 ~~ indusW3P2
indusW4S1 ~~ indusW4S2
indusW4P1 ~~ indusW4P2
'
lsmIndus <- sem(lsmIndus, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lsmIndus, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 142 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               224.996
##   Degrees of freedom                                78
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              1960.526
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
```

```
##
##    Comparative Fit Index (CFI)                       0.920
##    Tucker-Lewis Index (TLI)                          0.877
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)                 -1627.811
##    Loglikelihood unrestricted model (H1)         -1515.313
##
##    Akaike (AIC)                                   3403.621
##    Bayesian (BIC)                                 3666.827
##    Sample-size adjusted Bayesian (BIC)            3432.220
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                             0.085
##    90 Percent confidence interval - lower            0.072
##    90 Percent confidence interval - upper            0.098
##    P-value RMSEA <= 0.05                             0.000
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                              0.168
##
## Parameter Estimates:
##
##    Standard errors                               Standard
##    Information                                   Observed
##    Observed information based on                  Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    indus1 =~
##      indW1S1            1.000                                   1.000    1.000
##      indW1S2    (a)     1.391    0.123   11.266    0.000    1.149    1.633
##      indW1P1 (peer)     0.681    0.114    5.975    0.000    0.458    0.905
##      indW1P2   (aa)     0.534    0.129    4.138    0.000    0.281    0.787
##    indus2 =~
##      indW2S1            1.000                                   1.000    1.000
##      indW2S2    (a)     1.391    0.123   11.266    0.000    1.149    1.633
##      indW2P1 (peer)     0.681    0.114    5.975    0.000    0.458    0.905
##      indW2P2   (aa)     0.534    0.129    4.138    0.000    0.281    0.787
##    indus3 =~
##      indW3S1            1.000                                   1.000    1.000
##      indW3S2    (a)     1.391    0.123   11.266    0.000    1.149    1.633
##      indW3P1 (peer)     0.681    0.114    5.975    0.000    0.458    0.905
##      indW3P2   (aa)     0.534    0.129    4.138    0.000    0.281    0.787
##    indus4 =~
##      indW4S1            1.000                                   1.000    1.000
##      indW4S2    (a)     1.391    0.123   11.266    0.000    1.149    1.633
##      indW4P1 (peer)     0.681    0.114    5.975    0.000    0.458    0.905
##      indW4P2   (aa)     0.534    0.129    4.138    0.000    0.281    0.787
##    Std.lv  Std.all
##
```

```
##     0.401    0.684
##     0.558    0.764
##     0.273    0.438
##     0.214    0.336
##
##     0.455    0.748
##     0.632    0.856
##     0.310    0.514
##     0.243    0.392
##
##     0.406    0.668
##     0.565    0.789
##     0.277    0.451
##     0.217    0.370
##
##     0.418    0.737
##     0.581    0.833
##     0.284    0.434
##     0.223    0.383
##
## Regressions:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   indus4 ~
##     indus3          1.047    0.066   15.933    0.000    0.918    1.175
##   indus3 ~
##     indus2          0.886    0.062   14.275    0.000    0.764    1.007
##   indus2 ~
##     indus1          1.038    0.154    6.725    0.000    0.736    1.341
##    Std.lv  Std.all
##
##     1.018    1.018
##
##     0.991    0.991
##
##     0.915    0.915
##
## Covariances:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##  .indusW1S1 ~~
##    .indusW2S1        0.078    0.017    4.573    0.000    0.045    0.112
##    .indusW3S1        0.077    0.018    4.359    0.000    0.042    0.111
##    .indusW4S1        0.057    0.017    3.456    0.001    0.025    0.090
##  .indusW2S1 ~~
##    .indusW3S1        0.080    0.020    4.068    0.000    0.041    0.118
##    .indusW4S1        0.056    0.018    3.031    0.002    0.020    0.092
##  .indusW3S1 ~~
##    .indusW4S1        0.092    0.019    4.784    0.000    0.054    0.130
##  .indusW1S2 ~~
##    .indusW2S2        0.069    0.031    2.206    0.027    0.008    0.130
##    .indusW3S2        0.050    0.029    1.713    0.087   -0.007    0.106
##    .indusW4S2        0.026    0.030    0.877    0.381   -0.033    0.085
##  .indusW2S2 ~~
##    .indusW3S2        0.044    0.032    1.367    0.172   -0.019    0.108
##    .indusW4S2        0.008    0.033    0.229    0.819   -0.058    0.073
```

```
##    .indusW3S2 ~~
##       .indusW4S2        0.054    0.034    1.622    0.105   -0.011    0.120
##    .indusW1P1 ~~
##       .indusW2P1        0.138    0.032    4.353    0.000    0.076    0.200
##       .indusW3P1        0.131    0.033    3.974    0.000    0.067    0.196
##       .indusW4P1        0.175    0.037    4.731    0.000    0.102    0.247
##    .indusW2P1 ~~
##       .indusW3P1        0.176    0.037    4.807    0.000    0.104    0.248
##       .indusW4P1        0.184    0.038    4.864    0.000    0.110    0.258
##    .indusW3P1 ~~
##       .indusW4P1        0.235    0.042    5.545    0.000    0.152    0.319
##    .indusW1P2 ~~
##       .indusW2P2        0.165    0.036    4.584    0.000    0.095    0.236
##       .indusW3P2        0.165    0.036    4.576    0.000    0.094    0.235
##       .indusW4P2        0.169    0.041    4.176    0.000    0.090    0.249
##    .indusW2P2 ~~
##       .indusW3P2        0.176    0.040    4.429    0.000    0.098    0.254
##       .indusW4P2        0.198    0.038    5.160    0.000    0.123    0.274
##    .indusW3P2 ~~
##       .indusW4P2        0.194    0.038    5.091    0.000    0.120    0.269
##    .indusW1S1 ~~
##       .indusW1S2        0.047    0.034    1.352    0.177   -0.021    0.114
##    .indusW1P1 ~~
##       .indusW1P2        0.117    0.026    4.541    0.000    0.066    0.167
##    .indusW2S1 ~~
##       .indusW2S2        0.006    0.014    0.399    0.690   -0.022    0.033
##    .indusW2P1 ~~
##       .indusW2P2        0.072    0.021    3.407    0.001    0.031    0.113
##    .indusW3S1 ~~
##       .indusW3S2        0.019    0.012    1.560    0.119   -0.005    0.043
##    .indusW3P1 ~~
##       .indusW3P2        0.071    0.023    3.120    0.002    0.027    0.116
##    .indusW4S1 ~~
##       .indusW4S2        0.024    0.025    0.981    0.327   -0.024    0.073
##    .indusW4P1 ~~
##       .indusW4P2        0.021    0.022    0.986    0.324   -0.021    0.064
##    Std.lv  Std.all
##
##     0.078    0.455
##     0.077    0.398
##     0.057    0.350
##
##     0.080    0.436
##     0.056    0.360
##
##     0.092    0.532
##
##     0.069    0.383
##     0.050    0.239
##     0.026    0.145
##
##     0.044    0.265
##     0.008    0.052
##
```

```
##      0.054    0.321
##
##      0.138    0.475
##      0.131    0.428
##      0.175    0.528
##
##      0.176    0.622
##      0.184    0.601
##
##      0.235    0.728
##
##      0.165    0.483
##      0.165    0.503
##      0.169    0.525
##
##      0.176    0.567
##      0.198    0.647
##
##      0.194    0.663
##
##      0.047    0.231
##
##      0.117    0.346
##
##      0.006    0.037
##
##      0.072    0.244
##
##      0.019    0.095
##
##      0.071    0.239
##
##      0.024    0.165
##
##      0.021    0.067
##
## Intercepts:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##      .indusW1S1       3.340    0.036    91.671    0.000    3.269    3.412
##      .indusW1S2       3.025    0.045    66.613    0.000    2.936    3.114
##      .indusW1P1       3.776    0.049    76.583    0.000    3.679    3.872
##      .indusW1P2       3.627    0.051    71.395    0.000    3.527    3.726
##      .indusW2S1       3.311    0.041    81.673    0.000    3.231    3.390
##      .indusW2S2       2.966    0.049    60.694    0.000    2.870    3.062
##      .indusW2P1       3.736    0.048    77.739    0.000    3.642    3.831
##      .indusW2P2       3.628    0.050    72.099    0.000    3.530    3.727
##      .indusW3S1       3.326    0.041    80.650    0.000    3.245    3.407
##      .indusW3S2       3.027    0.048    62.650    0.000    2.932    3.122
##      .indusW3P1       3.748    0.050    75.147    0.000    3.651    3.846
##      .indusW3P2       3.617    0.049    73.888    0.000    3.521    3.713
##      .indusW4S1       3.327    0.040    82.589    0.000    3.248    3.406
##      .indusW4S2       3.058    0.050    61.677    0.000    2.961    3.155
##      .indusW4P1       3.681    0.056    65.547    0.000    3.571    3.791
##      .indusW4P2       3.538    0.051    69.715    0.000    3.438    3.637
```

```
##     indus1             0.000                              0.000    0.000
##    .indus2             0.000                              0.000    0.000
##    .indus3             0.000                              0.000    0.000
##    .indus4             0.000                              0.000    0.000
##    Std.lv  Std.all
##     3.340    5.701
##     3.025    4.143
##     3.776    6.055
##     3.627    5.691
##     3.311    5.446
##     2.966    4.015
##     3.736    6.196
##     3.628    5.856
##     3.326    5.469
##     3.027    4.230
##     3.748    6.109
##     3.617    6.160
##     3.327    5.871
##     3.058    4.384
##     3.681    5.617
##     3.538    6.078
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .indusW1S1        0.183    0.031    5.851    0.000    0.121    0.244
##    .indusW1S2        0.222    0.058    3.811    0.000    0.108    0.337
##    .indusW1P1        0.314    0.038    8.347    0.000    0.240    0.388
##    .indusW1P2        0.360    0.042    8.665    0.000    0.279    0.442
##    .indusW2S1        0.163    0.024    6.867    0.000    0.116    0.209
##    .indusW2S2        0.146    0.042    3.442    0.001    0.063    0.229
##    .indusW2P1        0.268    0.034    7.938    0.000    0.202    0.334
##    .indusW2P2        0.325    0.044    7.337    0.000    0.238    0.412
##    .indusW3S1        0.205    0.026    7.976    0.000    0.154    0.255
##    .indusW3S2        0.193    0.037    5.183    0.000    0.120    0.266
##    .indusW3P1        0.300    0.040    7.554    0.000    0.222    0.378
##    .indusW3P2        0.298    0.038    7.840    0.000    0.223    0.372
##    .indusW4S1        0.147    0.026    5.648    0.000    0.096    0.198
##    .indusW4S2        0.149    0.048    3.081    0.002    0.054    0.244
##    .indusW4P1        0.348    0.050    6.972    0.000    0.250    0.446
##    .indusW4P2        0.289    0.041    7.029    0.000    0.208    0.370
##     indus1           0.161    0.035    4.630    0.000    0.093    0.229
##    .indus2           0.034    0.026    1.291    0.197   -0.017    0.085
##    .indus3           0.003    0.009    0.311    0.756   -0.015    0.021
##    .indus4          -0.006    0.016   -0.389    0.697   -0.038    0.025
##    Std.lv  Std.all
##     0.183    0.532
##     0.222    0.417
##     0.314    0.808
##     0.360    0.887
##     0.163    0.440
```
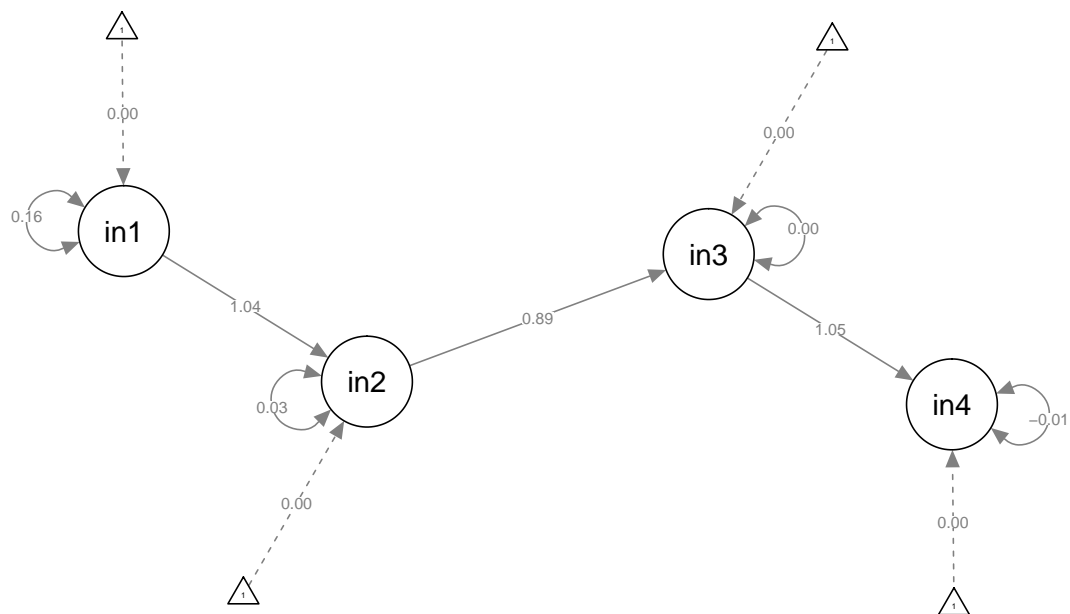
```
##     0.146     0.267
##     0.268     0.736
##     0.325     0.846
##     0.205     0.554
##     0.193     0.377
##     0.300     0.797
##     0.298     0.863
##     0.147     0.457
##     0.149     0.307
##     0.348     0.811
##     0.289     0.853
##     1.000     1.000
##     0.162     0.162
##     0.017     0.017
##    -0.036    -0.036
```

```r
semPaths(lsmIndus, what = "col", whatLabels = "est", structural = T, layout = "spring")
```


LSM Intellect

```r
lsmIntel <- '

# factor at each time point with same loading
intel1 =~ intelW1S1        + a * intelW1S2 +
          peer * intelW1P1 + aa * intelW1P2
```

```
intel2 =~ intelW2S1        + a * intelW2S2 +
          peer * intelW2P1 + aa * intelW2P2

intel3 =~ intelW3S1        + a * intelW3S2 +
          peer * intelW3P1 + aa * intelW3P2

intel4 =~ intelW4S1        + a * intelW4S2 +
          peer * intelW4P1 + aa * intelW4P2

# structural paths between time points
intel4 ~ intel3
intel3 ~ intel2
intel2 ~ intel1

# error covariance - similar parcels across waves
intelW1S1 ~~ intelW2S1 + intelW3S1 + intelW4S1
intelW2S1 ~~ intelW3S1 + intelW4S1
intelW3S1 ~~ intelW4S1

intelW1S2 ~~ intelW2S2 + intelW3S2 + intelW4S2
intelW2S2 ~~ intelW3S2 + intelW4S2
intelW3S2 ~~ intelW4S2

intelW1P1 ~~ intelW2P1 + intelW3P1 + intelW4P1
intelW2P1 ~~ intelW3P1 + intelW4P1
intelW3P1 ~~ intelW4P1

intelW1P2 ~~ intelW2P2 + intelW3P2 + intelW4P2
intelW2P2 ~~ intelW3P2 + intelW4P2
intelW3P2 ~~ intelW4P2

# error covariance - same method at one wave
intelW1S1 ~~ intelW1S2
intelW1P1 ~~ intelW1P2
intelW2S1 ~~ intelW2S2
intelW2P1 ~~ intelW2P2
intelW3S1 ~~ intelW3S2
intelW3P1 ~~ intelW3P2
intelW4S1 ~~ intelW4S2
intelW4P1 ~~ intelW4P2
'
lsmIntel <- sem(lsmIntel, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lsmIntel, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 178 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
```

```
##
##    Number of observations                            259
##    Number of missing patterns                         52
##
## Model Test User Model:
##
##    Test statistic                                218.233
##    Degrees of freedom                                 78
##    P-value (Chi-square)                            0.000
##
## Model Test Baseline Model:
##
##    Test statistic                               2029.552
##    Degrees of freedom                                120
##    P-value                                         0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                     0.927
##    Tucker-Lewis Index (TLI)                        0.887
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)               -1320.147
##    Loglikelihood unrestricted model (H1)       -1211.030
##
##    Akaike (AIC)                                 2788.293
##    Bayesian (BIC)                               3051.498
##    Sample-size adjusted Bayesian (BIC)          2816.892
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                           0.083
##    90 Percent confidence interval - lower          0.070
##    90 Percent confidence interval - upper          0.097
##    P-value RMSEA <= 0.05                           0.000
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                            0.171
##
## Parameter Estimates:
##
##    Standard errors                              Standard
##    Information                                  Observed
##    Observed information based on                 Hessian
##
## Latent Variables:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    intel1 =~
##      intW1S1        1.000                              1.000    1.000
##      intW1S2   (a)  1.101    0.107   10.322    0.000    0.892    1.311
##      intW1P1 (peer) 0.584    0.111    5.281    0.000    0.367    0.801
##      intW1P2  (aa)  0.408    0.107    3.800    0.000    0.198    0.619
```

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```
## intel2 =~
##   intW2S1              1.000                               1.000   1.000
##   intW2S2     (a)      1.101    0.107   10.322   0.000     0.892   1.311
##   intW2P1 (peer)       0.584    0.111    5.281   0.000     0.367   0.801
##   intW2P2    (aa)      0.408    0.107    3.800   0.000     0.198   0.619
## intel3 =~
##   intW3S1              1.000                               1.000   1.000
##   intW3S2     (a)      1.101    0.107   10.322   0.000     0.892   1.311
##   intW3P1 (peer)       0.584    0.111    5.281   0.000     0.367   0.801
##   intW3P2    (aa)      0.408    0.107    3.800   0.000     0.198   0.619
## intel4 =~
##   intW4S1              1.000                               1.000   1.000
##   intW4S2     (a)      1.101    0.107   10.322   0.000     0.892   1.311
##   intW4P1 (peer)       0.584    0.111    5.281   0.000     0.367   0.801
##   intW4P2    (aa)      0.408    0.107    3.800   0.000     0.198   0.619
##   Std.lv  Std.all
##
##   0.433    0.751
##   0.477    0.745
##   0.253    0.461
##   0.177    0.324
##
##   0.418    0.742
##   0.461    0.734
##   0.244    0.440
##   0.171    0.360
##
##   0.434    0.739
##   0.478    0.760
##   0.254    0.425
##   0.177    0.308
##
##   0.358    0.642
##   0.395    0.679
##   0.209    0.331
##   0.146    0.290
##
## Regressions:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   intel4 ~
##     intel3         0.945    0.066   14.424   0.000     0.816   1.073
##   intel3 ~
##     intel2         1.042    0.071   14.759   0.000     0.903   1.180
##   intel2 ~
##     intel1         0.941    0.099    9.507   0.000     0.747   1.135
##   Std.lv  Std.all
##
##   1.146    1.146
##
##   1.003    1.003
##
##   0.975    0.975
##
## Covariances:
```

```
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
## .intelW1S1 ~~
##    .intelW2S1         0.064    0.018    3.461    0.001    0.028    0.100
##    .intelW3S1         0.060    0.019    3.060    0.002    0.021    0.098
##    .intelW4S1         0.043    0.018    2.345    0.019    0.007    0.079
## .intelW2S1 ~~
##    .intelW3S1         0.071    0.020    3.560    0.000    0.032    0.111
##    .intelW4S1         0.045    0.019    2.412    0.016    0.008    0.082
## .intelW3S1 ~~
##    .intelW4S1         0.054    0.020    2.676    0.007    0.014    0.094
## .intelW1S2 ~~
##    .intelW2S2         0.067    0.022    3.031    0.002    0.024    0.111
##    .intelW3S2         0.046    0.023    2.059    0.040    0.002    0.091
##    .intelW4S2         0.050    0.022    2.291    0.022    0.007    0.093
## .intelW2S2 ~~
##    .intelW3S2         0.084    0.025    3.390    0.001    0.036    0.133
##    .intelW4S2         0.075    0.024    3.189    0.001    0.029    0.122
## .intelW3S2 ~~
##    .intelW4S2         0.061    0.024    2.595    0.009    0.015    0.107
## .intelW1P1 ~~
##    .intelW2P1         0.135    0.029    4.700    0.000    0.079    0.191
##    .intelW3P1         0.183    0.031    5.831    0.000    0.122    0.245
##    .intelW4P1         0.149    0.031    4.836    0.000    0.089    0.209
## .intelW2P1 ~~
##    .intelW3P1         0.191    0.034    5.534    0.000    0.123    0.259
##    .intelW4P1         0.155    0.036    4.347    0.000    0.085    0.224
## .intelW3P1 ~~
##    .intelW4P1         0.173    0.040    4.282    0.000    0.094    0.252
## .intelW1P2 ~~
##    .intelW2P2         0.165    0.025    6.635    0.000    0.117    0.214
##    .intelW3P2         0.180    0.032    5.528    0.000    0.116    0.243
##    .intelW4P2         0.136    0.028    4.912    0.000    0.082    0.190
## .intelW2P2 ~~
##    .intelW3P2         0.158    0.029    5.470    0.000    0.101    0.214
##    .intelW4P2         0.127    0.023    5.446    0.000    0.081    0.173
## .intelW3P2 ~~
##    .intelW4P2         0.157    0.033    4.806    0.000    0.093    0.221
## .intelW1S1 ~~
##    .intelW1S2         0.038    0.023    1.645    0.100   -0.007    0.082
## .intelW1P1 ~~
##    .intelW1P2         0.058    0.013    4.302    0.000    0.031    0.084
## .intelW2S1 ~~
##    .intelW2S2         0.029    0.010    3.020    0.003    0.010    0.049
## .intelW2P1 ~~
##    .intelW2P2         0.027    0.012    2.191    0.028    0.003    0.051
## .intelW3S1 ~~
##    .intelW3S2         0.013    0.010    1.273    0.203   -0.007    0.033
## .intelW3P1 ~~
##    .intelW3P2         0.027    0.018    1.522    0.128   -0.008    0.061
## .intelW4S1 ~~
##    .intelW4S2         0.066    0.031    2.114    0.035    0.005    0.127
## .intelW4P1 ~~
##    .intelW4P2         0.113    0.027    4.169    0.000    0.060    0.166
##    Std.lv  Std.all
```

```
##
##      0.064    0.442
##      0.060    0.395
##      0.043    0.264
##
##      0.071    0.478
##      0.045    0.280
##
##      0.054    0.320
##
##      0.067    0.370
##      0.046    0.265
##      0.050    0.274
##
##      0.084    0.483
##      0.075    0.415
##
##      0.061    0.350
##
##      0.135    0.555
##      0.183    0.696
##      0.149    0.512
##
##      0.191    0.709
##      0.155    0.520
##
##      0.173    0.537
##
##      0.165    0.725
##      0.180    0.635
##      0.136    0.546
##
##      0.158    0.650
##      0.127    0.597
##
##      0.157    0.593
##
##      0.038    0.231
##
##      0.058    0.230
##
##      0.029    0.183
##
##      0.027    0.122
##
##      0.013    0.081
##
##      0.027    0.090
##
##      0.066    0.362
##
##      0.113    0.393
##
## Intercepts:
```

```
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .intelW1S1          3.712    0.036  103.457    0.000    3.642    3.782
##    .intelW1S2          3.620    0.040   90.878    0.000    3.542    3.698
##    .intelW1P1          3.998    0.043   93.712    0.000    3.914    4.081
##    .intelW1P2          4.002    0.043   93.515    0.000    3.918    4.086
##    .intelW2S1          3.644    0.037   97.637    0.000    3.571    3.718
##    .intelW2S2          3.595    0.042   86.044    0.000    3.513    3.676
##    .intelW2P1          3.960    0.045   88.781    0.000    3.872    4.047
##    .intelW2P2          4.026    0.038  106.690    0.000    3.952    4.100
##    .intelW3S1          3.658    0.039   93.180    0.000    3.581    3.735
##    .intelW3S2          3.631    0.042   85.934    0.000    3.549    3.714
##    .intelW3P1          3.979    0.048   82.997    0.000    3.885    4.073
##    .intelW3P2          3.936    0.048   82.087    0.000    3.842    4.030
##    .intelW4S1          3.683    0.040   91.958    0.000    3.605    3.762
##    .intelW4S2          3.644    0.041   89.607    0.000    3.564    3.724
##    .intelW4P1          3.856    0.058   66.734    0.000    3.743    3.970
##    .intelW4P2          3.910    0.046   85.924    0.000    3.821    3.999
##     intel1             0.000                              0.000    0.000
##    .intel2             0.000                              0.000    0.000
##    .intel3             0.000                              0.000    0.000
##    .intel4             0.000                              0.000    0.000
##    Std.lv  Std.all
##     3.712    6.433
##     3.620    5.652
##     3.998    7.288
##     4.002    7.334
##     3.644    6.465
##     3.595    5.727
##     3.960    7.134
##     4.026    8.492
##     3.658    6.223
##     3.631    5.770
##     3.979    6.666
##     3.936    6.832
##     3.683    6.597
##     3.644    6.274
##     3.856    6.096
##     3.910    7.763
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .intelW1S1          0.145    0.029    4.947    0.000    0.088    0.203
##    .intelW1S2          0.183    0.034    5.388    0.000    0.116    0.249
##    .intelW1P1          0.237    0.030    7.975    0.000    0.179    0.295
##    .intelW1P2          0.266    0.032    8.447    0.000    0.205    0.328
##    .intelW2S1          0.143    0.022    6.420    0.000    0.099    0.186
##    .intelW2S2          0.182    0.029    6.239    0.000    0.125    0.239
##    .intelW2P1          0.248    0.034    7.383    0.000    0.182    0.314
##    .intelW2P2          0.196    0.024    8.021    0.000    0.148    0.243
##    .intelW3S1          0.157    0.025    6.161    0.000    0.107    0.207
```

```
##    .intelW3S2        0.167   0.029   5.773   0.000   0.110   0.224
##    .intelW3P1        0.292   0.039   7.427   0.000   0.215   0.369
##    .intelW3P2        0.300   0.040   7.533   0.000   0.222   0.379
##    .intelW4S1        0.183   0.035   5.181   0.000   0.114   0.253
##    .intelW4S2        0.182   0.038   4.772   0.000   0.107   0.256
##    .intelW4P1        0.356   0.047   7.658   0.000   0.265   0.448
##    .intelW4P2        0.232   0.029   8.037   0.000   0.176   0.289
##     intel1           0.188   0.036   5.234   0.000   0.117   0.258
##    .intel2           0.009   0.017   0.515   0.607  -0.025   0.042
##    .intel3          -0.001   0.009  -0.145   0.884  -0.018   0.016
##    .intel4          -0.040   0.025  -1.606   0.108  -0.089   0.009
##    Std.lv  Std.all
##     0.145   0.436
##     0.183   0.445
##     0.237   0.787
##     0.266   0.895
##     0.143   0.449
##     0.182   0.461
##     0.248   0.806
##     0.196   0.870
##     0.157   0.454
##     0.167   0.422
##     0.292   0.819
##     0.300   0.905
##     0.183   0.588
##     0.182   0.539
##     0.356   0.891
##     0.232   0.916
##     1.000   1.000
##     0.050   0.050
##    -0.007  -0.007
##    -0.312  -0.312
```

```r
semPaths(lsmIntel, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
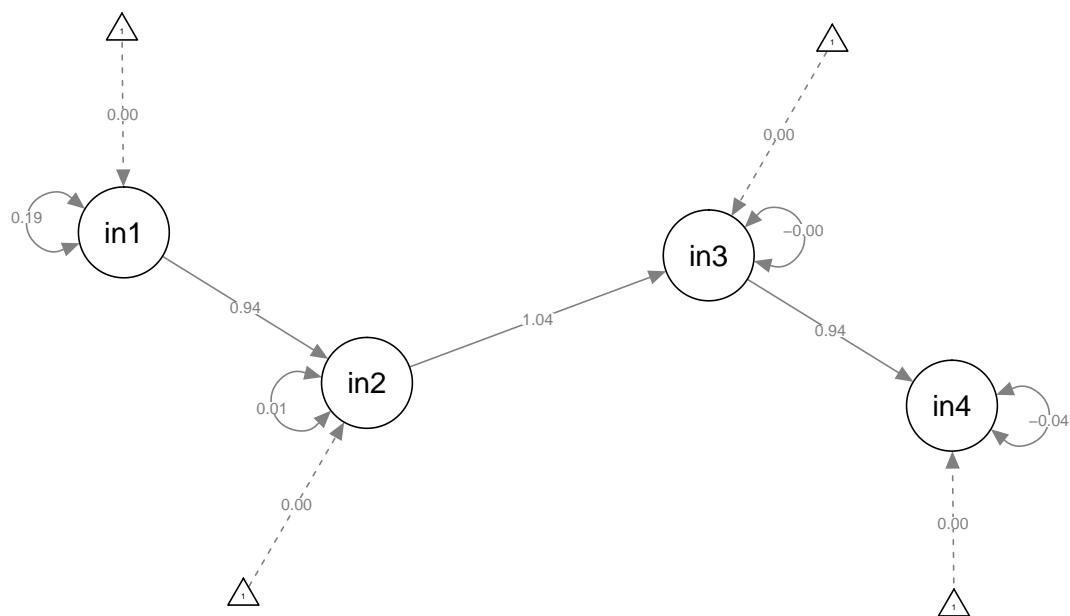
LSM Openness aspect

```
lsmOpena <- '

# factor at each time point with same loading
opena1 =~ openaW1S1       + a * openaW1S2 +
          peer * openaW1P1 + aa * openaW1P2

opena2 =~ openaW2S1       + a * openaW2S2 +
          peer * openaW2P1 + aa * openaW2P2

opena3 =~ openaW3S1       + a * openaW3S2 +
          peer * openaW3P1 + aa * openaW3P2

opena4 =~ openaW4S1       + a * openaW4S2 +
          peer * openaW4P1 + aa * openaW4P2

# structural paths between time points
opena4 ~ opena3
opena3 ~ opena2
opena2 ~ opena1

# error covariance - similar parcels across waves
openaW1S1 ~~ openaW2S1 + openaW3S1 + openaW4S1
openaW2S1 ~~ openaW3S1 + openaW4S1
```

```
openaW3S1 ~~ openaW4S1

openaW1S2 ~~ openaW2S2 + openaW3S2 + openaW4S2
openaW2S2 ~~ openaW3S2 + openaW4S2
openaW3S2 ~~ openaW4S2

openaW1P1 ~~ openaW2P1 + openaW3P1 + openaW4P1
openaW2P1 ~~ openaW3P1 + openaW4P1
openaW3P1 ~~ openaW4P1

openaW1P2 ~~ openaW2P2 + openaW3P2 + openaW4P2
openaW2P2 ~~ openaW3P2 + openaW4P2
openaW3P2 ~~ openaW4P2

# error covariance - same method at one wave
openaW1S1 ~~ openaW1S2
openaW1P1 ~~ openaW1P2
openaW2S1 ~~ openaW2S2
openaW2P1 ~~ openaW2P2
openaW3S1 ~~ openaW3S2
openaW3P1 ~~ openaW3P2
openaW4S1 ~~ openaW4S2
openaW4P1 ~~ openaW4P2
'
lsmOpena <- sem(lsmOpena, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lsmOpena, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 187 iterations
##
##    Estimator                                         ML
##    Optimization method                           NLMINB
##    Number of free parameters                         83
##    Number of equality constraints                     9
##
##    Number of observations                           259
##    Number of missing patterns                        52
##
## Model Test User Model:
##
##    Test statistic                               146.582
##    Degrees of freedom                                78
##    P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##    Test statistic                              2368.492
##    Degrees of freedom                               120
##    P-value                                        0.000
##
## User Model versus Baseline Model:
```

```
##
##    Comparative Fit Index (CFI)                        0.969
##    Tucker-Lewis Index (TLI)                           0.953
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)             -1140.330
##    Loglikelihood unrestricted model (H1)     -1067.039
##
##    Akaike (AIC)                               2428.660
##    Bayesian (BIC)                             2691.866
##    Sample-size adjusted Bayesian (BIC)        2457.259
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                         0.058
##    90 Percent confidence interval - lower        0.044
##    90 Percent confidence interval - upper        0.073
##    P-value RMSEA <= 0.05                          0.168
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                          0.114
##
## Parameter Estimates:
##
##    Standard errors                            Standard
##    Information                                Observed
##    Observed information based on               Hessian
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    opena1 =~
##      opnW1S1           1.000                                    1.000    1.000
##      opnW1S2    (a)    0.906    0.063   14.304    0.000    0.782    1.030
##      opnW1P1 (peer)    0.628    0.076    8.318    0.000    0.480    0.776
##      opnW1P2   (aa)    0.479    0.076    6.296    0.000    0.330    0.628
##    opena2 =~
##      opnW2S1           1.000                                    1.000    1.000
##      opnW2S2    (a)    0.906    0.063   14.304    0.000    0.782    1.030
##      opnW2P1 (peer)    0.628    0.076    8.318    0.000    0.480    0.776
##      opnW2P2   (aa)    0.479    0.076    6.296    0.000    0.330    0.628
##    opena3 =~
##      opnW3S1           1.000                                    1.000    1.000
##      opnW3S2    (a)    0.906    0.063   14.304    0.000    0.782    1.030
##      opnW3P1 (peer)    0.628    0.076    8.318    0.000    0.480    0.776
##      opnW3P2   (aa)    0.479    0.076    6.296    0.000    0.330    0.628
##    opena4 =~
##      opnW4S1           1.000                                    1.000    1.000
##      opnW4S2    (a)    0.906    0.063   14.304    0.000    0.782    1.030
##      opnW4P1 (peer)    0.628    0.076    8.318    0.000    0.480    0.776
##      opnW4P2   (aa)    0.479    0.076    6.296    0.000    0.330    0.628
##     Std.lv  Std.all
##
```

```
##     0.484     0.737
##     0.438     0.765
##     0.304     0.558
##     0.232     0.478
##
##     0.538     0.798
##     0.487     0.807
##     0.338     0.598
##     0.257     0.462
##
##     0.541     0.828
##     0.490     0.864
##     0.340     0.618
##     0.259     0.491
##
##     0.474     0.717
##     0.430     0.742
##     0.298     0.548
##     0.227     0.460
##
## Regressions:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   opena4 ~
##     opena3            0.913    0.047   19.282    0.000    0.820    1.006
##   opena3 ~
##     opena2            1.003    0.046   21.721    0.000    0.912    1.093
##   opena2 ~
##     opena1            1.108    0.091   12.148    0.000    0.929    1.286
##    Std.lv  Std.all
##
##     1.041    1.041
##
##     0.997    0.997
##
##     0.996    0.996
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##  .openaW1S1 ~~
##    .openaW2S1         0.108    0.020    5.526    0.000    0.070    0.146
##    .openaW3S1         0.086    0.018    4.851    0.000    0.051    0.121
##    .openaW4S1         0.103    0.020    5.165    0.000    0.064    0.142
##  .openaW2S1 ~~
##    .openaW3S1         0.082    0.019    4.429    0.000    0.046    0.118
##    .openaW4S1         0.095    0.021    4.632    0.000    0.055    0.135
##  .openaW3S1 ~~
##    .openaW4S1         0.089    0.019    4.562    0.000    0.051    0.127
##  .openaW1S2 ~~
##    .openaW2S2         0.033    0.015    2.152    0.031    0.003    0.063
##    .openaW3S2         0.035    0.014    2.522    0.012    0.008    0.063
##    .openaW4S2         0.040    0.016    2.480    0.013    0.008    0.072
##  .openaW2S2 ~~
##    .openaW3S2         0.049    0.015    3.223    0.001    0.019    0.078
##    .openaW4S2         0.051    0.017    2.957    0.003    0.017    0.084
```

```
##  .openaW3S2 ~~
##     .openaW4S2         0.049   0.016   3.116   0.002   0.018   0.081
##  .openaW1P1 ~~
##     .openaW2P1         0.095   0.022   4.410   0.000   0.053   0.137
##     .openaW3P1         0.101   0.022   4.622   0.000   0.058   0.143
##     .openaW4P1         0.035   0.026   1.360   0.174  -0.016   0.086
##  .openaW2P1 ~~
##     .openaW3P1         0.135   0.025   5.510   0.000   0.087   0.183
##     .openaW4P1         0.083   0.028   3.011   0.003   0.029   0.137
##  .openaW3P1 ~~
##     .openaW4P1         0.110   0.029   3.798   0.000   0.053   0.166
##  .openaW1P2 ~~
##     .openaW2P2         0.129   0.022   5.874   0.000   0.086   0.172
##     .openaW3P2         0.099   0.022   4.432   0.000   0.055   0.143
##     .openaW4P2         0.111   0.021   5.225   0.000   0.069   0.153
##  .openaW2P2 ~~
##     .openaW3P2         0.149   0.027   5.499   0.000   0.096   0.202
##     .openaW4P2         0.133   0.026   5.047   0.000   0.082   0.185
##  .openaW3P2 ~~
##     .openaW4P2         0.140   0.029   4.788   0.000   0.083   0.197
##  .openaW1S1 ~~
##     .openaW1S2         0.043   0.017   2.597   0.009   0.011   0.075
##  .openaW1P1 ~~
##     .openaW1P2         0.045   0.013   3.503   0.000   0.020   0.070
##  .openaW2S1 ~~
##     .openaW2S2         0.030   0.009   3.470   0.001   0.013   0.047
##  .openaW2P1 ~~
##     .openaW2P2         0.031   0.013   2.411   0.016   0.006   0.055
##  .openaW3S1 ~~
##     .openaW3S2         0.011   0.007   1.539   0.124  -0.003   0.024
##  .openaW3P1 ~~
##     .openaW3P2         0.018   0.011   1.654   0.098  -0.003   0.040
##  .openaW4S1 ~~
##     .openaW4S2         0.055   0.023   2.461   0.014   0.011   0.100
##  .openaW4P1 ~~
##     .openaW4P2         0.045   0.021   2.179   0.029   0.004   0.085
##    Std.lv  Std.all
##
##    0.108    0.599
##    0.086    0.531
##    0.103    0.502
##
##    0.082    0.552
##    0.095    0.507
##
##    0.089    0.526
##
##    0.033    0.249
##    0.035    0.334
##    0.040    0.279
##
##    0.049    0.479
##    0.051    0.367
##
```

```
##      0.049    0.447
##
##      0.095    0.465
##      0.101    0.516
##      0.035    0.171
##
##      0.135    0.692
##      0.083    0.403
##
##      0.110    0.559
##
##      0.129    0.614
##      0.099    0.507
##      0.111    0.597
##
##      0.149    0.654
##      0.133    0.615
##
##      0.140    0.695
##
##      0.043    0.262
##
##      0.045    0.234
##
##      0.030    0.207
##
##      0.031    0.137
##
##      0.011    0.103
##
##      0.018    0.091
##
##      0.055    0.310
##
##      0.045    0.224
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##      .openaW1S1       3.865    0.041   94.717    0.000     3.785     3.945
##      .openaW1S2       3.916    0.036  109.899    0.000     3.846     3.985
##      .openaW1P1       3.859    0.042   91.185    0.000     3.776     3.941
##      .openaW1P2       3.656    0.038   97.377    0.000     3.582     3.729
##      .openaW2S1       3.812    0.044   87.125    0.000     3.727     3.898
##      .openaW2S2       3.861    0.040   96.555    0.000     3.783     3.940
##      .openaW2P1       3.827    0.044   87.519    0.000     3.741     3.913
##      .openaW2P2       3.595    0.044   81.576    0.000     3.509     3.682
##      .openaW3S1       3.825    0.043   89.604    0.000     3.741     3.908
##      .openaW3S2       3.910    0.037  104.970    0.000     3.837     3.983
##      .openaW3P1       3.837    0.043   89.734    0.000     3.753     3.920
##      .openaW3P2       3.657    0.043   85.878    0.000     3.574     3.741
##      .openaW4S1       3.869    0.046   84.932    0.000     3.780     3.958
##      .openaW4S2       3.937    0.041   97.187    0.000     3.858     4.017
##      .openaW4P1       3.728    0.048   77.391    0.000     3.633     3.822
##      .openaW4P2       3.644    0.042   86.414    0.000     3.562     3.727
```

```
##      opena1              0.000                                      0.000    0.000
##     .opena2              0.000                                      0.000    0.000
##     .opena3              0.000                                      0.000    0.000
##     .opena4              0.000                                      0.000    0.000
##    Std.lv  Std.all
##     3.865    5.888
##     3.916    6.834
##     3.859    7.088
##     3.656    7.551
##     3.812    5.658
##     3.861    6.397
##     3.827    6.779
##     3.595    6.448
##     3.825    5.857
##     3.910    6.897
##     3.837    6.981
##     3.657    6.933
##     3.869    5.847
##     3.937    6.800
##     3.728    6.853
##     3.644    7.383
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .openaW1S1        0.197    0.027    7.426    0.000    0.145    0.249
##    .openaW1S2        0.136    0.023    6.057    0.000    0.092    0.180
##    .openaW1P1        0.204    0.026    7.988    0.000    0.154    0.254
##    .openaW1P2        0.181    0.022    8.301    0.000    0.138    0.223
##    .openaW2S1        0.165    0.024    6.941    0.000    0.119    0.212
##    .openaW2S2        0.127    0.020    6.243    0.000    0.087    0.167
##    .openaW2P1        0.205    0.028    7.308    0.000    0.150    0.260
##    .openaW2P2        0.245    0.030    8.140    0.000    0.186    0.304
##    .openaW3S1        0.134    0.021    6.427    0.000    0.093    0.175
##    .openaW3S2        0.081    0.017    4.892    0.000    0.049    0.114
##    .openaW3P1        0.187    0.027    6.868    0.000    0.133    0.240
##    .openaW3P2        0.211    0.031    6.754    0.000    0.150    0.273
##    .openaW4S1        0.213    0.035    6.137    0.000    0.145    0.281
##    .openaW4S2        0.151    0.027    5.555    0.000    0.097    0.204
##    .openaW4P1        0.207    0.031    6.586    0.000    0.145    0.269
##    .openaW4P2        0.192    0.027    7.026    0.000    0.138    0.246
##     opena1           0.234    0.039    6.036    0.000    0.158    0.310
##    .opena2           0.002    0.019    0.110    0.912   -0.035    0.039
##    .opena3           0.002    0.008    0.250    0.803   -0.014    0.018
##    .opena4          -0.019    0.022   -0.858    0.391   -0.062    0.024
##    Std.lv  Std.all
##     0.197    0.457
##     0.136    0.415
##     0.204    0.688
##     0.181    0.771
##     0.165    0.364
```
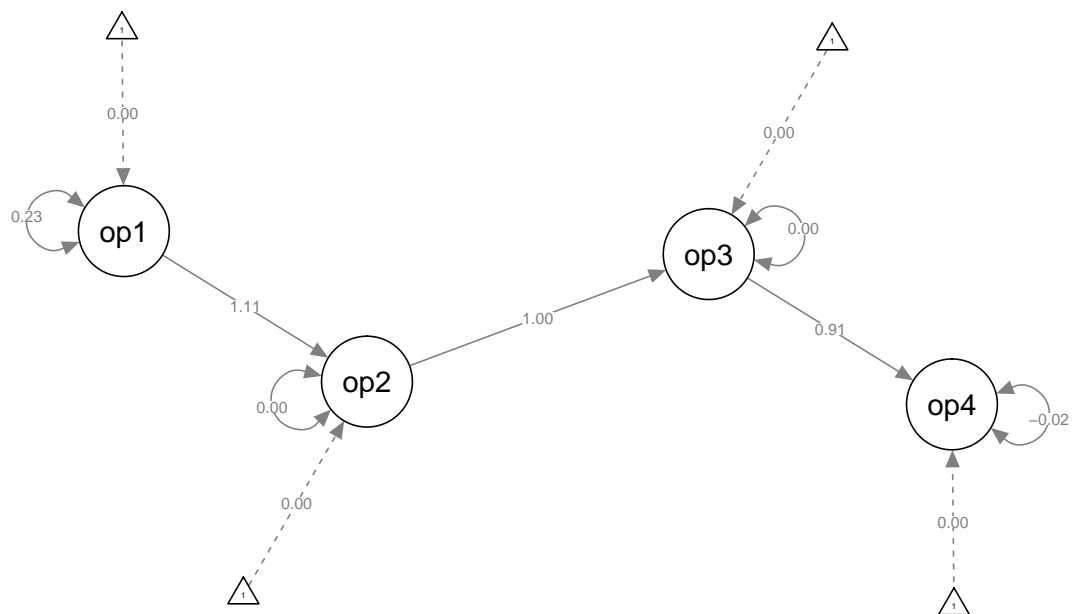
```
##      0.127     0.349
##      0.205     0.642
##      0.245     0.787
##      0.134     0.314
##      0.081     0.253
##      0.187     0.618
##      0.211     0.759
##      0.213     0.486
##      0.151     0.449
##      0.207     0.700
##      0.192     0.788
##      1.000     1.000
##      0.007     0.007
##      0.007     0.007
##     -0.083    -0.083
```

```
semPaths(lsmOpena, what = "col", whatLabels = "est", structural = T, layout = "spring")
```


LSM Orderliness

```
lsmOrder <- '

# factor at each time point with same loading
order1 =~ orderW1S1        + a * orderW1S2 +
          peer * orderW1P1 + aa * orderW1P2
```

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```
order2 =~ orderW2S1        + a * orderW2S2 +
          peer * orderW2P1 + aa * orderW2P2

order3 =~ orderW3S1        + a * orderW3S2 +
          peer * orderW3P1 + aa * orderW3P2

order4 =~ orderW4S1        + a * orderW4S2 +
          peer * orderW4P1 + aa * orderW4P2

# structural paths between time points
order4 ~ order3
order3 ~ order2
order2 ~ order1

# error covariance - similar parcels across waves
orderW1S1 ~~ orderW2S1 + orderW3S1 + orderW4S1
orderW2S1 ~~ orderW3S1 + orderW4S1
orderW3S1 ~~ orderW4S1

orderW1S2 ~~ orderW2S2 + orderW3S2 + orderW4S2
orderW2S2 ~~ orderW3S2 + orderW4S2
orderW3S2 ~~ orderW4S2

orderW1P1 ~~ orderW2P1 + orderW3P1 + orderW4P1
orderW2P1 ~~ orderW3P1 + orderW4P1
orderW3P1 ~~ orderW4P1

orderW1P2 ~~ orderW2P2 + orderW3P2 + orderW4P2
orderW2P2 ~~ orderW3P2 + orderW4P2
orderW3P2 ~~ orderW4P2

# error covariance - same method at one wave
orderW1S1 ~~ orderW1S2
orderW1P1 ~~ orderW1P2
orderW2S1 ~~ orderW2S2
orderW2P1 ~~ orderW2P2
orderW3S1 ~~ orderW3S2
orderW3P1 ~~ orderW3P2
orderW4S1 ~~ orderW4S2
orderW4P1 ~~ orderW4P2
'
lsmOrder <- sem(lsmOrder, data = data, missing = "ML")

## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative

summary(lsmOrder, fit.measures = T, standardized = T, ci = T)

## lavaan 0.6-7 ended normally after 136 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
```

```
##
##    Number of observations                          259
##    Number of missing patterns                        52
##
## Model Test User Model:
##
##    Test statistic                              162.667
##    Degrees of freedom                               78
##    P-value (Chi-square)                          0.000
##
## Model Test Baseline Model:
##
##    Test statistic                             2131.446
##    Degrees of freedom                              120
##    P-value                                       0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                   0.958
##    Tucker-Lewis Index (TLI)                      0.935
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)             -1600.261
##    Loglikelihood unrestricted model (H1)     -1518.927
##
##    Akaike (AIC)                               3348.521
##    Bayesian (BIC)                             3611.727
##    Sample-size adjusted Bayesian (BIC)        3377.120
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                         0.065
##    90 Percent confidence interval - lower        0.051
##    90 Percent confidence interval - upper        0.079
##    P-value RMSEA <= 0.05                         0.043
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                          0.110
##
## Parameter Estimates:
##
##    Standard errors                            Standard
##    Information                                Observed
##    Observed information based on               Hessian
##
## Latent Variables:
##               Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    order1 =~
##      ordW1S1           1.000                                1.000    1.000
##      ordW1S2    (a)    0.790    0.054   14.610    0.000     0.684    0.896
##      ordW1P1 (peer)    0.780    0.097    8.032    0.000     0.589    0.970
##      ordW1P2   (aa)    0.558    0.075    7.410    0.000     0.410    0.705
```

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```
##   order2 =~
##     ordW2S1               1.000                               1.000    1.000
##     ordW2S2      (a)      0.790    0.054   14.610   0.000      0.684    0.896
##     ordW2P1 (peer)       0.780    0.097    8.032   0.000      0.589    0.970
##     ordW2P2     (aa)      0.558    0.075    7.410   0.000      0.410    0.705
##   order3 =~
##     ordW3S1               1.000                               1.000    1.000
##     ordW3S2      (a)      0.790    0.054   14.610   0.000      0.684    0.896
##     ordW3P1 (peer)       0.780    0.097    8.032   0.000      0.589    0.970
##     ordW3P2     (aa)      0.558    0.075    7.410   0.000      0.410    0.705
##   order4 =~
##     ordW4S1               1.000                               1.000    1.000
##     ordW4S2      (a)      0.790    0.054   14.610   0.000      0.684    0.896
##     ordW4P1 (peer)       0.780    0.097    8.032   0.000      0.589    0.970
##     ordW4P2     (aa)      0.558    0.075    7.410   0.000      0.410    0.705
##    Std.lv  Std.all
##
##    0.533    0.762
##    0.421    0.662
##    0.415    0.569
##    0.297    0.489
##
##    0.540    0.808
##    0.426    0.703
##    0.421    0.619
##    0.301    0.560
##
##    0.566    0.830
##    0.447    0.749
##    0.442    0.574
##    0.316    0.555
##
##    0.561    0.803
##    0.443    0.714
##    0.437    0.585
##    0.313    0.551
##
## Regressions:
##                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   order4 ~
##     order3           0.977    0.057   17.051   0.000    0.865    1.090
##   order3 ~
##     order2           1.060    0.053   19.928   0.000    0.956    1.164
##   order2 ~
##     order1           1.013    0.094   10.754   0.000    0.828    1.198
##    Std.lv  Std.all
##
##    0.987    0.987
##
##    1.010    1.010
##
##    1.000    1.000
##
## Covariances:
```

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```
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
## .orderW1S1 ~~
##    .orderW2S1          0.005    0.021    0.219    0.827   -0.037    0.046
##    .orderW3S1          0.027    0.022    1.249    0.212   -0.015    0.069
##    .orderW4S1          0.004    0.023    0.180    0.857   -0.041    0.050
## .orderW2S1 ~~
##    .orderW3S1          0.030    0.023    1.305    0.192   -0.015    0.076
##    .orderW4S1         -0.004    0.023   -0.188    0.851   -0.049    0.041
## .orderW3S1 ~~
##    .orderW4S1          0.041    0.024    1.718    0.086   -0.006    0.088
## .orderW1S2 ~~
##    .orderW2S2          0.088    0.016    5.397    0.000    0.056    0.120
##    .orderW3S2          0.060    0.015    3.924    0.000    0.030    0.090
##    .orderW4S2          0.060    0.017    3.523    0.000    0.027    0.094
## .orderW2S2 ~~
##    .orderW3S2          0.073    0.016    4.417    0.000    0.040    0.105
##    .orderW4S2          0.073    0.018    4.069    0.000    0.038    0.108
## .orderW3S2 ~~
##    .orderW4S2          0.084    0.017    5.062    0.000    0.051    0.116
## .orderW1P1 ~~
##    .orderW2P1          0.164    0.036    4.499    0.000    0.093    0.235
##    .orderW3P1          0.187    0.044    4.219    0.000    0.100    0.273
##    .orderW4P1          0.187    0.041    4.519    0.000    0.106    0.268
## .orderW2P1 ~~
##    .orderW3P1          0.214    0.041    5.280    0.000    0.135    0.294
##    .orderW4P1          0.212    0.038    5.578    0.000    0.138    0.287
## .orderW3P1 ~~
##    .orderW4P1          0.280    0.047    5.974    0.000    0.188    0.372
## .orderW1P2 ~~
##    .orderW2P2          0.124    0.026    4.713    0.000    0.073    0.176
##    .orderW3P2          0.128    0.029    4.442    0.000    0.072    0.185
##    .orderW4P2          0.095    0.027    3.529    0.000    0.042    0.147
## .orderW2P2 ~~
##    .orderW3P2          0.129    0.025    5.056    0.000    0.079    0.179
##    .orderW4P2          0.104    0.024    4.263    0.000    0.056    0.151
## .orderW3P2 ~~
##    .orderW4P2          0.084    0.029    2.890    0.004    0.027    0.140
## .orderW1S1 ~~
##    .orderW1S2          0.086    0.023    3.755    0.000    0.041    0.131
## .orderW1P1 ~~
##    .orderW1P2          0.085    0.025    3.436    0.001    0.037    0.134
## .orderW2S1 ~~
##    .orderW2S2          0.001    0.012    0.109    0.913   -0.022    0.025
## .orderW2P1 ~~
##    .orderW2P2          0.029    0.013    2.189    0.029    0.003    0.056
## .orderW3S1 ~~
##    .orderW3S2          0.011    0.011    1.065    0.287   -0.010    0.032
## .orderW3P1 ~~
##    .orderW3P2          0.055    0.020    2.789    0.005    0.016    0.094
## .orderW4S1 ~~
##    .orderW4S2          0.061    0.028    2.167    0.030    0.006    0.116
## .orderW4P1 ~~
##    .orderW4P2          0.091    0.026    3.491    0.000    0.040    0.142
##    Std.lv  Std.all
```

```
##
##      0.005    0.026
##      0.027    0.157
##      0.004    0.022
##
##      0.030    0.203
##     -0.004   -0.026
##
##      0.041    0.260
##
##      0.088    0.428
##      0.060    0.319
##      0.060    0.291
##
##      0.073    0.426
##      0.073    0.388
##
##      0.084    0.488
##
##      0.164    0.512
##      0.187    0.493
##      0.187    0.512
##
##      0.214    0.638
##      0.212    0.656
##
##      0.280    0.732
##
##      0.124    0.526
##      0.128    0.511
##      0.095    0.377
##
##      0.129    0.611
##      0.104    0.492
##
##      0.084    0.373
##
##      0.086    0.398
##
##      0.085    0.268
##
##      0.001    0.008
##
##      0.029    0.124
##
##      0.011    0.075
##
##      0.055    0.186
##
##      0.061    0.335
##
##      0.091    0.316
##
## Intercepts:
```

```
##                       Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##      .orderW1S1          3.397    0.044   78.094    0.000     3.312     3.483
##      .orderW1S2          3.727    0.040   94.324    0.000     3.649     3.804
##      .orderW1P1          3.240    0.056   58.032    0.000     3.131     3.350
##      .orderW1P2          3.521    0.047   74.533    0.000     3.429     3.614
##      .orderW2S1          3.488    0.045   77.797    0.000     3.400     3.576
##      .orderW2S2          3.791    0.040   93.813    0.000     3.712     3.870
##      .orderW2P1          3.342    0.052   64.184    0.000     3.240     3.444
##      .orderW2P2          3.571    0.042   85.107    0.000     3.489     3.653
##      .orderW3S1          3.489    0.046   76.583    0.000     3.400     3.579
##      .orderW3S2          3.761    0.040   93.836    0.000     3.683     3.840
##      .orderW3P1          3.274    0.060   54.203    0.000     3.155     3.392
##      .orderW3P2          3.494    0.046   75.887    0.000     3.404     3.584
##      .orderW4S1          3.518    0.050   69.865    0.000     3.419     3.617
##      .orderW4S2          3.784    0.045   84.864    0.000     3.697     3.872
##      .orderW4P1          3.210    0.061   52.223    0.000     3.090     3.331
##      .orderW4P2          3.415    0.051   66.630    0.000     3.315     3.516
##       order1             0.000                                0.000     0.000
##      .order2             0.000                                0.000     0.000
##      .order3             0.000                                0.000     0.000
##      .order4             0.000                                0.000     0.000
##     Std.lv   Std.all
##      3.397    4.857
##      3.727    5.866
##      3.240    4.436
##      3.521    5.795
##      3.488    5.225
##      3.791    6.254
##      3.342    4.921
##      3.571    6.646
##      3.489    5.113
##      3.761    6.300
##      3.274    4.255
##      3.494    6.135
##      3.518    5.037
##      3.784    6.094
##      3.210    4.292
##      3.415    6.015
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##
## Variances:
##                       Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##      .orderW1S1          0.206    0.036    5.771    0.000     0.136     0.275
##      .orderW1S2          0.226    0.026    8.842    0.000     0.176     0.277
##      .orderW1P1          0.361    0.044    8.205    0.000     0.275     0.447
##      .orderW1P2          0.281    0.033    8.475    0.000     0.216     0.346
##      .orderW2S1          0.155    0.027    5.621    0.000     0.101     0.208
##      .orderW2S2          0.186    0.022    8.400    0.000     0.142     0.229
##      .orderW2P1          0.284    0.039    7.365    0.000     0.209     0.360
##      .orderW2P2          0.198    0.027    7.267    0.000     0.145     0.252
##      .orderW3S1          0.145    0.029    5.018    0.000     0.088     0.202
```

```
##     .orderW3S2          0.156    0.019    8.092    0.000    0.118    0.194
##     .orderW3P1          0.397    0.053    7.466    0.000    0.293    0.501
##     .orderW3P2          0.225    0.030    7.395    0.000    0.165    0.284
##     .orderW4S1          0.173    0.044    3.964    0.000    0.087    0.258
##     .orderW4S2          0.189    0.030    6.281    0.000    0.130    0.248
##     .orderW4P1          0.368    0.050    7.329    0.000    0.270    0.467
##     .orderW4P2          0.224    0.032    7.001    0.000    0.162    0.287
##      order1             0.284    0.047    6.077    0.000    0.192    0.375
##     .order2            -0.000    0.023   -0.005    0.996   -0.045    0.045
##     .order3            -0.006    0.012   -0.506    0.613   -0.030    0.018
##     .order4             0.008    0.031    0.267    0.789   -0.053    0.070
##     Std.lv  Std.all
##      0.206    0.420
##      0.226    0.561
##      0.361    0.677
##      0.281    0.761
##      0.155    0.347
##      0.186    0.506
##      0.284    0.616
##      0.198    0.686
##      0.145    0.311
##      0.156    0.438
##      0.397    0.671
##      0.225    0.692
##      0.173    0.355
##      0.189    0.491
##      0.368    0.658
##      0.224    0.696
##      1.000    1.000
##     -0.000   -0.000
##     -0.019   -0.019
##      0.027    0.027
```

```r
semPaths(lsmOrder, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
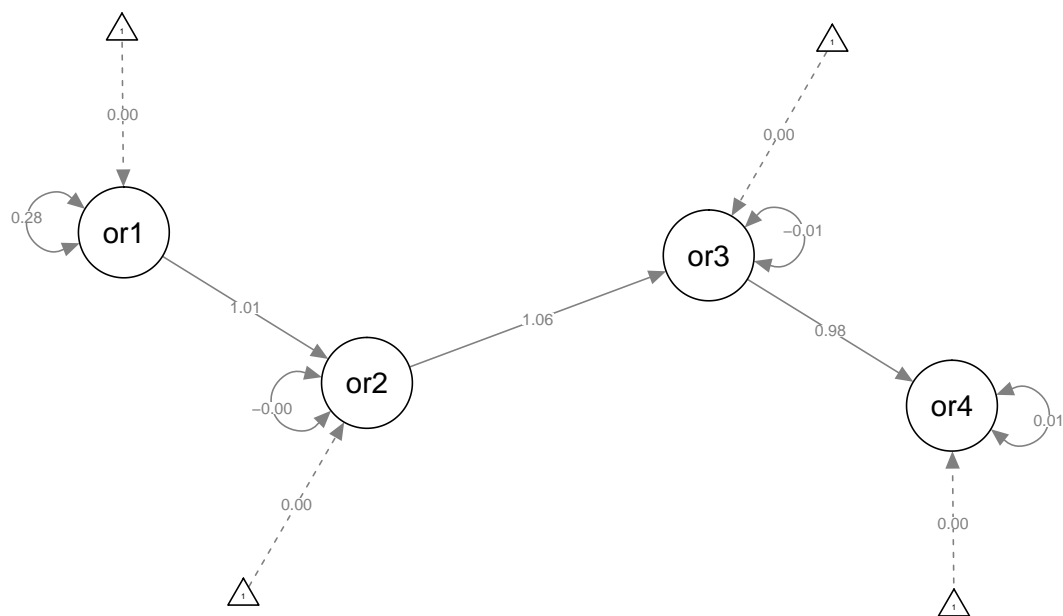
LSM Politeness

```
lsmPolit <- '

# factor at each time point with same loading
polit1 =~ politW1S1        + a * politW1S2 +
          peer * politW1P1 + aa * politW1P2

polit2 =~ politW2S1        + a * politW2S2 +
          peer * politW2P1 + aa * politW2P2

polit3 =~ politW3S1        + a * politW3S2 +
          peer * politW3P1 + aa * politW3P2

polit4 =~ politW4S1        + a * politW4S2 +
          peer * politW4P1 + aa * politW4P2

# structural paths between time points
polit4 ~ polit3
polit3 ~ polit2
polit2 ~ polit1

# error covariance - similar parcels across waves
politW1S1 ~~ politW2S1 + politW3S1 + politW4S1
politW2S1 ~~ politW3S1 + politW4S1
```

```
politW3S1 ~~ politW4S1

politW1S2 ~~ politW2S2 + politW3S2 + politW4S2
politW2S2 ~~ politW3S2 + politW4S2
politW3S2 ~~ politW4S2

politW1P1 ~~ politW2P1 + politW3P1 + politW4P1
politW2P1 ~~ politW3P1 + politW4P1
politW3P1 ~~ politW4P1

politW1P2 ~~ politW2P2 + politW3P2 + politW4P2
politW2P2 ~~ politW3P2 + politW4P2
politW3P2 ~~ politW4P2

# error covariance - same method at one wave
politW1S1 ~~ politW1S2
politW1P1 ~~ politW1P2
politW2S1 ~~ politW2S2
politW2P1 ~~ politW2P2
politW3S1 ~~ politW3S2
politW3P1 ~~ politW3P2
politW4S1 ~~ politW4S2
politW4P1 ~~ politW4P2
'
lsmPolit <- sem(lsmPolit, data = data, missing = "ML")
summary(lsmPolit, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 153 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               148.718
##   Degrees of freedom                                78
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              1979.092
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.962
##   Tucker-Lewis Index (TLI)                       0.941
##
```

```
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)            -1498.565
##   Loglikelihood unrestricted model (H1)    -1424.206
##
##   Akaike (AIC)                              3145.129
##   Bayesian (BIC)                            3408.334
##   Sample-size adjusted Bayesian (BIC)       3173.728
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                         0.059
##   90 Percent confidence interval - lower        0.045
##   90 Percent confidence interval - upper        0.074
##   P-value RMSEA <= 0.05                         0.143
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                          0.094
##
## Parameter Estimates:
##
##   Standard errors                           Standard
##   Information                               Observed
##   Observed information based on              Hessian
##
## Latent Variables:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   polit1 =~
##     pltW1S1          1.000                                1.000    1.000
##     pltW1S2   (a)    0.851    0.097    8.768    0.000    0.661    1.041
##     pltW1P1 (peer)   1.157    0.132    8.736    0.000    0.897    1.416
##     pltW1P2  (aa)    1.330    0.148    8.962    0.000    1.039    1.620
##   polit2 =~
##     pltW2S1          1.000                                1.000    1.000
##     pltW2S2   (a)    0.851    0.097    8.768    0.000    0.661    1.041
##     pltW2P1 (peer)   1.157    0.132    8.736    0.000    0.897    1.416
##     pltW2P2  (aa)    1.330    0.148    8.962    0.000    1.039    1.620
##   polit3 =~
##     pltW3S1          1.000                                1.000    1.000
##     pltW3S2   (a)    0.851    0.097    8.768    0.000    0.661    1.041
##     pltW3P1 (peer)   1.157    0.132    8.736    0.000    0.897    1.416
##     pltW3P2  (aa)    1.330    0.148    8.962    0.000    1.039    1.620
##   polit4 =~
##     pltW4S1          1.000                                1.000    1.000
##     pltW4S2   (a)    0.851    0.097    8.768    0.000    0.661    1.041
##     pltW4P1 (peer)   1.157    0.132    8.736    0.000    0.897    1.416
##     pltW4P2  (aa)    1.330    0.148    8.962    0.000    1.039    1.620
##    Std.lv  Std.all
##
##    0.385    0.593
##    0.328    0.576
##    0.446    0.711
##    0.512    0.802
```

```
##
##     0.381     0.575
##     0.324     0.567
##     0.440     0.723
##     0.506     0.792
##
##     0.423     0.633
##     0.360     0.592
##     0.489     0.739
##     0.562     0.831
##
##     0.437     0.699
##     0.372     0.590
##     0.505     0.813
##     0.581     0.810
##
## Regressions:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   polit4 ~
##     polit3            1.022    0.061   16.729    0.000     0.902     1.142
##   polit3 ~
##     polit2            1.063    0.071   14.970    0.000     0.924     1.202
##   polit2 ~
##     polit1            0.934    0.080   11.721    0.000     0.778     1.091
##    Std.lv  Std.all
##
##     0.990     0.990
##
##     0.957     0.957
##
##     0.945     0.945
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   .politW1S1 ~~
##     .politW2S1        0.198    0.027    7.416    0.000     0.146     0.250
##     .politW3S1        0.168    0.025    6.647    0.000     0.119     0.218
##     .politW4S1        0.143    0.024    5.985    0.000     0.096     0.189
##   .politW2S1 ~~
##     .politW3S1        0.205    0.029    6.983    0.000     0.147     0.262
##     .politW4S1        0.153    0.027    5.697    0.000     0.100     0.206
##   .politW3S1 ~~
##     .politW4S1        0.156    0.028    5.655    0.000     0.102     0.210
##   .politW1S2 ~~
##     .politW2S2        0.097    0.020    4.797    0.000     0.057     0.136
##     .politW3S2        0.109    0.020    5.350    0.000     0.069     0.150
##     .politW4S2        0.098    0.023    4.258    0.000     0.053     0.143
##   .politW2S2 ~~
##     .politW3S2        0.136    0.023    5.903    0.000     0.091     0.181
##     .politW4S2        0.138    0.025    5.503    0.000     0.089     0.187
##   .politW3S2 ~~
##     .politW4S2        0.165    0.028    5.963    0.000     0.111     0.219
##   .politW1P1 ~~
##     .politW2P1        0.078    0.019    4.102    0.000     0.040     0.115
```

```
##    .politW3P1          0.064    0.018    3.480    0.001    0.028    0.100
##    .politW4P1          0.067    0.021    3.210    0.001    0.026    0.107
## .politW2P1 ~~
##    .politW3P1          0.051    0.018    2.783    0.005    0.015    0.086
##    .politW4P1          0.063    0.022    2.853    0.004    0.020    0.106
## .politW3P1 ~~
##    .politW4P1          0.044    0.020    2.157    0.031    0.004    0.084
## .politW1P2 ~~
##    .politW2P2          0.004    0.021    0.214    0.831   -0.036    0.045
##    .politW3P2         -0.007    0.018   -0.403    0.687   -0.043    0.029
##    .politW4P2         -0.015    0.029   -0.513    0.608   -0.072    0.042
## .politW2P2 ~~
##    .politW3P2          0.030    0.020    1.488    0.137   -0.010    0.070
##    .politW4P2          0.045    0.025    1.768    0.077   -0.005    0.095
## .politW3P2 ~~
##    .politW4P2          0.068    0.025    2.775    0.006    0.020    0.117
## .politW1S1 ~~
##    .politW1S2          0.041    0.014    3.053    0.002    0.015    0.068
## .politW1P1 ~~
##    .politW1P2          0.063    0.023    2.793    0.005    0.019    0.107
## .politW2S1 ~~
##    .politW2S2          0.015    0.010    1.481    0.139   -0.005    0.035
## .politW2P1 ~~
##    .politW2P2          0.031    0.017    1.858    0.063   -0.002    0.064
## .politW3S1 ~~
##    .politW3S2          0.023    0.010    2.353    0.019    0.004    0.042
## .politW3P1 ~~
##    .politW3P2          0.071    0.021    3.398    0.001    0.030    0.112
## .politW4S1 ~~
##    .politW4S2          0.000    0.014    0.005    0.996   -0.028    0.028
## .politW4P1 ~~
##    .politW4P2          0.021    0.024    0.854    0.393   -0.027    0.069
##    Std.lv  Std.all
##
##    0.198    0.698
##    0.168    0.622
##    0.143    0.610
##
##    0.205    0.732
##    0.153    0.633
##
##    0.156    0.675
##
##    0.097    0.442
##    0.109    0.480
##    0.098    0.413
##
##    0.136    0.591
##    0.138    0.576
##
##    0.165    0.662
##
##    0.078    0.418
##    0.064    0.325
```

```
##     0.067    0.418
##
##     0.051    0.269
##     0.063    0.411
##
##     0.044    0.272
##
##     0.004    0.030
##    -0.007   -0.052
##    -0.015   -0.093
##
##     0.030    0.205
##     0.045    0.274
##
##     0.068    0.431
##
##     0.041    0.170
##
##     0.063    0.375
##
##     0.015    0.060
##
##     0.031    0.190
##
##     0.023    0.091
##
##     0.071    0.422
##
##     0.000    0.000
##
##     0.021    0.137
##
## Intercepts:
##                 Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##     .politW1S1     3.809    0.040   94.241    0.000     3.730     3.888
##     .politW1S2     3.588    0.035  101.262    0.000     3.519     3.658
##     .politW1P1     3.642    0.048   76.434    0.000     3.548     3.735
##     .politW1P2     4.009    0.048   82.736    0.000     3.914     4.104
##     .politW2S1     3.822    0.043   88.068    0.000     3.737     3.907
##     .politW2S2     3.647    0.039   94.454    0.000     3.571     3.722
##     .politW2P1     3.626    0.048   75.990    0.000     3.532     3.719
##     .politW2P2     3.974    0.050   80.002    0.000     3.877     4.072
##     .politW3S1     3.810    0.044   85.893    0.000     3.723     3.897
##     .politW3S2     3.658    0.041   88.948    0.000     3.577     3.738
##     .politW3P1     3.609    0.053   67.517    0.000     3.504     3.714
##     .politW3P2     3.982    0.053   75.567    0.000     3.878     4.085
##     .politW4S1     3.880    0.043   89.437    0.000     3.795     3.965
##     .politW4S2     3.670    0.045   80.973    0.000     3.581     3.759
##     .politW4P1     3.598    0.052   69.446    0.000     3.496     3.699
##     .politW4P2     3.827    0.060   64.087    0.000     3.710     3.944
##      polit1        0.000                                0.000     0.000
##     .polit2        0.000                                0.000     0.000
##     .polit3        0.000                                0.000     0.000
##     .polit4        0.000                                0.000     0.000
```

```
##     Std.lv  Std.all
##      3.809    5.860
##      3.588    6.299
##      3.642    5.814
##      4.009    6.275
##      3.822    5.774
##      3.647    6.383
##      3.626    5.951
##      3.974    6.220
##      3.810    5.703
##      3.658    6.018
##      3.609    5.450
##      3.982    5.883
##      3.880    6.213
##      3.670    5.825
##      3.598    5.792
##      3.827    5.337
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##      0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##    .politW1S1        0.274    0.029    9.505    0.000     0.218     0.331
##    .politW1S2        0.217    0.024    9.195    0.000     0.171     0.263
##    .politW1P1        0.194    0.030    6.491    0.000     0.135     0.252
##    .politW1P2        0.146    0.031    4.653    0.000     0.084     0.207
##    .politW2S1        0.293    0.034    8.686    0.000     0.227     0.359
##    .politW2S2        0.221    0.026    8.400    0.000     0.170     0.273
##    .politW2P1        0.177    0.026    6.771    0.000     0.126     0.229
##    .politW2P2        0.152    0.029    5.248    0.000     0.095     0.209
##    .politW3S1        0.267    0.033    8.221    0.000     0.204     0.331
##    .politW3S2        0.240    0.028    8.433    0.000     0.184     0.296
##    .politW3P1        0.199    0.031    6.392    0.000     0.138     0.260
##    .politW3P2        0.142    0.028    5.029    0.000     0.087     0.197
##    .politW4S1        0.199    0.030    6.596    0.000     0.140     0.259
##    .politW4S2        0.259    0.035    7.489    0.000     0.191     0.327
##    .politW4P1        0.131    0.030    4.375    0.000     0.072     0.189
##    .politW4P2        0.177    0.043    4.096    0.000     0.092     0.262
##     polit1           0.148    0.030    4.901    0.000     0.089     0.208
##    .polit2           0.015    0.010    1.478    0.140    -0.005     0.036
##    .polit3           0.015    0.009    1.701    0.089    -0.002     0.032
##    .polit4           0.004    0.013    0.284    0.776    -0.022     0.030
##     Std.lv  Std.all
##      0.274    0.649
##      0.217    0.669
##      0.194    0.494
##      0.146    0.357
##      0.293    0.669
##      0.221    0.678
##      0.177    0.478
##      0.152    0.372
##      0.267    0.599
```
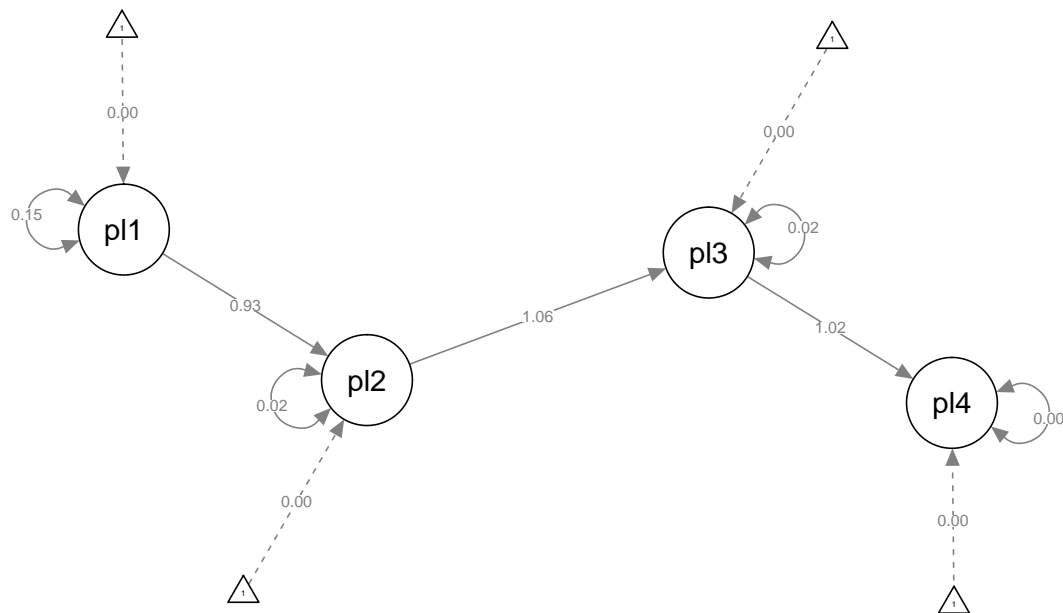
```
##      0.240    0.649
##      0.199    0.454
##      0.142    0.310
##      0.199    0.511
##      0.259    0.652
##      0.131    0.339
##      0.177    0.345
##      1.000    1.000
##      0.106    0.106
##      0.084    0.084
##      0.020    0.020
```

```r
semPaths(lsmPolit, what = "col", whatLabels = "est", structural = T, layout = "spring")
```


LSM Volatility

```r
lsmVolat <- '

# factor at each time point with same loading
volat1 =~ volatW1S1      + a * volatW1S2 +
          peer * volatW1P1 + aa * volatW1P2

volat2 =~ volatW2S1      + a * volatW2S2 +
          peer * volatW2P1 + aa * volatW2P2

volat3 =~ volatW3S1      + a * volatW3S2 +
```

```
          peer * volatW3P1 + aa * volatW3P2

volat4 =~ volatW4S1        + a * volatW4S2 +
          peer * volatW4P1 + aa * volatW4P2

# structural paths between time points
volat4 ~ volat3
volat3 ~ volat2
volat2 ~ volat1

# error covariance - similar parcels across waves
volatW1S1 ~~ volatW2S1 + volatW3S1 + volatW4S1
volatW2S1 ~~ volatW3S1 + volatW4S1
volatW3S1 ~~ volatW4S1


volatW1S2 ~~ volatW2S2 + volatW3S2 + volatW4S2
volatW2S2 ~~ volatW3S2 + volatW4S2
volatW3S2 ~~ volatW4S2


volatW1P1 ~~ volatW2P1 + volatW3P1 + volatW4P1
volatW2P1 ~~ volatW3P1 + volatW4P1
volatW3P1 ~~ volatW4P1


volatW1P2 ~~ volatW2P2 + volatW3P2 + volatW4P2
volatW2P2 ~~ volatW3P2 + volatW4P2
volatW3P2 ~~ volatW4P2


# error covariance - same method at one wave
volatW1S1 ~~ volatW1S2
volatW1P1 ~~ volatW1P2
volatW2S1 ~~ volatW2S2
volatW2P1 ~~ volatW2P2
volatW3S1 ~~ volatW3S2
volatW3P1 ~~ volatW3P2
volatW4S1 ~~ volatW4S2
volatW4P1 ~~ volatW4P2
'
lsmVolat <- sem(lsmVolat, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lsmVolat, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 133 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
```

```
## Model Test User Model:
##
##   Test statistic                               331.954
##   Degrees of freedom                                78
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2829.311
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.906
##   Tucker-Lewis Index (TLI)                       0.856
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1820.277
##   Loglikelihood unrestricted model (H1)      -1654.300
##
##   Akaike (AIC)                                3788.554
##   Bayesian (BIC)                              4051.759
##   Sample-size adjusted Bayesian (BIC)         3817.153
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.112
##   90 Percent confidence interval - lower         0.100
##   90 Percent confidence interval - upper         0.125
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.201
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
##
## Latent Variables:
##                 Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   volat1 =~
##     vltW1S1            1.000                                   1.000    1.000
##     vltW1S2   (a)      0.894    0.039   22.999    0.000    0.818    0.970
##     vltW1P1 (peer)     0.565    0.054   10.464    0.000    0.459    0.670
##     vltW1P2  (aa)      0.555    0.055   10.163    0.000    0.448    0.662
##   volat2 =~
##     vltW2S1            1.000                                   1.000    1.000
##     vltW2S2   (a)      0.894    0.039   22.999    0.000    0.818    0.970
##     vltW2P1 (peer)     0.565    0.054   10.464    0.000    0.459    0.670
```

```
##      vltW2P2    (aa)    0.555    0.055    10.163    0.000    0.448    0.662
##    volat3 =~
##      vltW3S1            1.000                               1.000    1.000
##      vltW3S2    (a)     0.894    0.039    22.999    0.000    0.818    0.970
##      vltW3P1  (peer)    0.565    0.054    10.464    0.000    0.459    0.670
##      vltW3P2    (aa)    0.555    0.055    10.163    0.000    0.448    0.662
##    volat4 =~
##      vltW4S1            1.000                               1.000    1.000
##      vltW4S2    (a)     0.894    0.039    22.999    0.000    0.818    0.970
##      vltW4P1  (peer)    0.565    0.054    10.464    0.000    0.459    0.670
##      vltW4P2    (aa)    0.555    0.055    10.163    0.000    0.448    0.662
##    Std.lv  Std.all
##
##    0.641    0.760
##    0.572    0.748
##    0.362    0.455
##    0.356    0.450
##
##    0.786    0.890
##    0.703    0.899
##    0.444    0.597
##    0.436    0.587
##
##    0.697    0.894
##    0.623    0.831
##    0.393    0.461
##    0.387    0.502
##
##    0.568    0.650
##    0.508    0.664
##    0.321    0.433
##    0.315    0.433
##
## Regressions:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    volat4 ~
##      volat3           0.991    0.057    17.528    0.000    0.880    1.102
##    volat3 ~
##      volat2           0.871    0.040    21.741    0.000    0.793    0.950
##    volat2 ~
##      volat1           1.289    0.168     7.687    0.000    0.961    1.618
##    Std.lv  Std.all
##
##    1.216    1.216
##
##    0.983    0.983
##
##    1.050    1.050
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .volatW1S1 ~~
##     .volatW2S1        0.033    0.021     1.541    0.123   -0.009    0.074
##     .volatW3S1        0.009    0.018     0.485    0.627   -0.026    0.044
```

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```
##     .volatW4S1          0.045   0.024   1.893   0.058  -0.002   0.092
## .volatW2S1 ~~
##     .volatW3S1          0.030   0.019   1.626   0.104  -0.006   0.067
##     .volatW4S1          0.022   0.024   0.886   0.375  -0.026   0.070
## .volatW3S1 ~~
##     .volatW4S1          0.026   0.021   1.253   0.210  -0.015   0.068
## .volatW1S2 ~~
##     .volatW2S2          0.037   0.017   2.216   0.027   0.004   0.070
##     .volatW3S2          0.054   0.016   3.295   0.001   0.022   0.085
##     .volatW4S2          0.023   0.019   1.246   0.213  -0.013   0.060
## .volatW2S2 ~~
##     .volatW3S2          0.055   0.016   3.432   0.001   0.024   0.087
##     .volatW4S2          0.024   0.017   1.397   0.162  -0.010   0.058
## .volatW3S2 ~~
##     .volatW4S2          0.040   0.017   2.412   0.016   0.008   0.073
## .volatW1P1 ~~
##     .volatW2P1          0.027   0.024   1.112   0.266  -0.020   0.074
##     .volatW3P1         -0.036   0.028  -1.292   0.196  -0.092   0.019
##     .volatW4P1          0.038   0.025   1.500   0.134  -0.012   0.088
## .volatW2P1 ~~
##     .volatW3P1          0.027   0.027   1.002   0.316  -0.026   0.080
##     .volatW4P1          0.050   0.026   1.937   0.053  -0.001   0.101
## .volatW3P1 ~~
##     .volatW4P1         -0.054   0.032  -1.674   0.094  -0.118   0.009
## .volatW1P2 ~~
##     .volatW2P2          0.052   0.022   2.351   0.019   0.009   0.095
##     .volatW3P2          0.073   0.023   3.158   0.002   0.028   0.118
##     .volatW4P2          0.039   0.026   1.516   0.130  -0.011   0.090
## .volatW2P2 ~~
##     .volatW3P2          0.018   0.023   0.774   0.439  -0.028   0.064
##     .volatW4P2          0.049   0.025   1.952   0.051  -0.000   0.098
## .volatW3P2 ~~
##     .volatW4P2          0.097   0.024   4.079   0.000   0.051   0.144
## .volatW1S1 ~~
##     .volatW1S2          0.145   0.049   2.960   0.003   0.049   0.241
## .volatW1P1 ~~
##     .volatW1P2          0.407   0.058   6.991   0.000   0.293   0.521
## .volatW2S1 ~~
##     .volatW2S2          0.010   0.016   0.653   0.514  -0.020   0.041
## .volatW2P1 ~~
##     .volatW2P2          0.251   0.045   5.626   0.000   0.164   0.339
## .volatW3S1 ~~
##     .volatW3S2          0.051   0.015   3.291   0.001   0.020   0.081
## .volatW3P1 ~~
##     .volatW3P2          0.417   0.066   6.303   0.000   0.287   0.546
## .volatW4S1 ~~
##     .volatW4S2          0.258   0.068   3.804   0.000   0.125   0.390
## .volatW4P1 ~~
##     .volatW4P2          0.344   0.062   5.538   0.000   0.222   0.465
##    Std.lv  Std.all
##
##    0.033    0.148
##    0.009    0.046
##    0.045    0.124
```

```
##
##      0.030    0.217
##      0.022    0.081
##
##      0.026    0.114
##
##      0.037    0.213
##      0.054    0.253
##      0.023    0.080
##
##      0.055    0.388
##      0.024    0.123
##
##      0.040    0.169
##
##      0.027    0.063
##     -0.036   -0.068
##      0.038    0.081
##
##      0.027    0.060
##      0.050    0.127
##
##     -0.054   -0.108
##
##      0.052    0.122
##      0.073    0.155
##      0.039    0.085
##
##      0.018    0.045
##      0.049    0.124
##
##      0.097    0.223
##
##      0.145    0.520
##
##      0.407    0.814
##
##      0.010    0.074
##
##      0.251    0.700
##
##      0.051    0.348
##
##      0.417    0.826
##
##      0.258    0.678
##
##      0.344    0.786
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .volatW1S1        2.851    0.052   54.389    0.000    2.748    2.954
##     .volatW1S2        2.708    0.048   56.894    0.000    2.614    2.801
##     .volatW1P1        2.529    0.063   39.861    0.000    2.405    2.654
```

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```
##     .volatW1P2        2.531    0.063   40.117    0.000    2.407    2.654
##     .volatW2S1        2.863    0.058   49.453    0.000    2.749    2.976
##     .volatW2S2        2.718    0.051   53.253    0.000    2.618    2.818
##     .volatW2P1        2.603    0.060   43.364    0.000    2.486    2.721
##     .volatW2P2        2.575    0.060   42.830    0.000    2.457    2.693
##     .volatW3S1        2.824    0.052   54.789    0.000    2.723    2.925
##     .volatW3S2        2.670    0.050   53.778    0.000    2.573    2.768
##     .volatW3P1        2.638    0.075   35.191    0.000    2.492    2.785
##     .volatW3P2        2.555    0.066   38.650    0.000    2.426    2.685
##     .volatW4S1        2.833    0.062   45.531    0.000    2.711    2.955
##     .volatW4S2        2.719    0.054   49.983    0.000    2.613    2.826
##     .volatW4P1        2.715    0.069   39.355    0.000    2.580    2.850
##     .volatW4P2        2.651    0.067   39.723    0.000    2.520    2.782
##      volat1           0.000                              0.000    0.000
##     .volat2           0.000                              0.000    0.000
##     .volat3           0.000                              0.000    0.000
##     .volat4           0.000                              0.000    0.000
##    Std.lv  Std.all
##     2.851    3.382
##     2.708    3.538
##     2.529    3.181
##     2.531    3.200
##     2.863    3.243
##     2.718    3.479
##     2.603    3.504
##     2.575    3.461
##     2.824    3.623
##     2.670    3.563
##     2.638    3.094
##     2.555    3.314
##     2.833    3.241
##     2.719    3.558
##     2.715    3.670
##     2.651    3.643
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##     0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .volatW1S1        0.300    0.058    5.211    0.000    0.187    0.413
##     .volatW1S2        0.258    0.048    5.367    0.000    0.164    0.352
##     .volatW1P1        0.501    0.064    7.787    0.000    0.375    0.628
##     .volatW1P2        0.499    0.059    8.391    0.000    0.383    0.616
##     .volatW2S1        0.161    0.031    5.281    0.000    0.101    0.221
##     .volatW2S2        0.117    0.023    5.185    0.000    0.073    0.161
##     .volatW2P1        0.355    0.047    7.517    0.000    0.262    0.448
##     .volatW2P2        0.363    0.047    7.686    0.000    0.270    0.455
##     .volatW3S1        0.122    0.023    5.222    0.000    0.076    0.167
##     .volatW3S2        0.174    0.024    7.206    0.000    0.126    0.221
##     .volatW3P1        0.572    0.085    6.698    0.000    0.405    0.740
##     .volatW3P2        0.445    0.060    7.400    0.000    0.327    0.563
##     .volatW4S1        0.441    0.080    5.487    0.000    0.284    0.599
```

```
##     .volatW4S2            0.327    0.063    5.175    0.000    0.203    0.450
##     .volatW4P1            0.444    0.069    6.426    0.000    0.309    0.580
##     .volatW4P2            0.430    0.060    7.130    0.000    0.312    0.548
##      volat1               0.410    0.074    5.547    0.000    0.265    0.555
##     .volat2              -0.064    0.084   -0.761    0.447   -0.228    0.100
##     .volat3               0.017    0.017    0.977    0.329   -0.017    0.050
##     .volat4              -0.154    0.066   -2.332    0.020   -0.284   -0.025
##     Std.lv  Std.all
##      0.300    0.423
##      0.258    0.441
##      0.501    0.793
##      0.499    0.798
##      0.161    0.207
##      0.117    0.191
##      0.355    0.643
##      0.363    0.656
##      0.122    0.200
##      0.174    0.309
##      0.572    0.787
##      0.445    0.748
##      0.441    0.578
##      0.327    0.559
##      0.444    0.812
##      0.430    0.812
##      1.000    1.000
##     -0.103   -0.103
##      0.034    0.034
##     -0.479   -0.479
```

```r
semPaths(lsmVolat, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
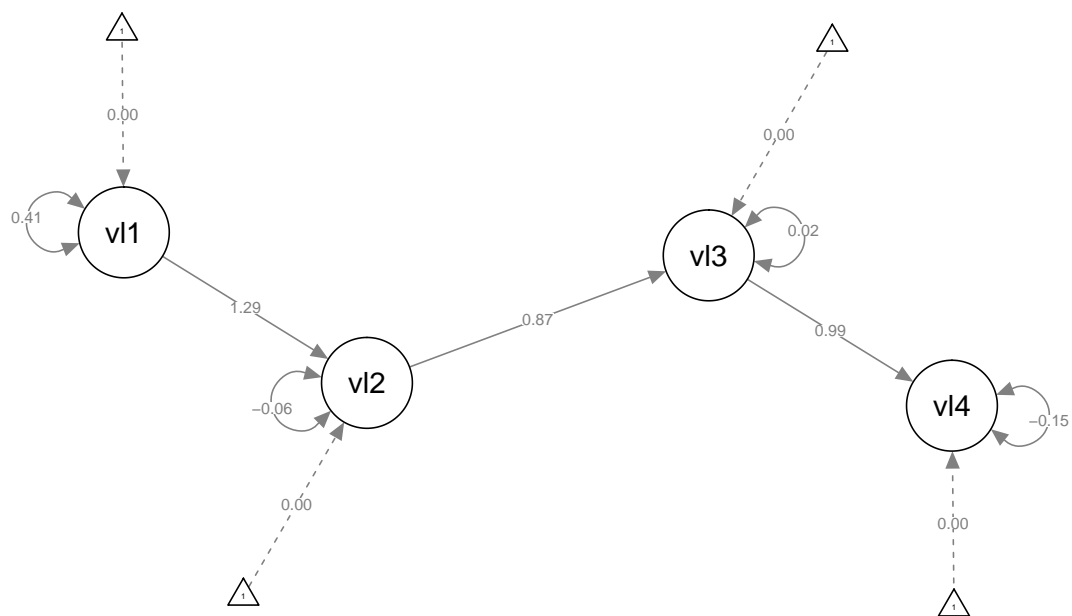
LSM Withdrawal

```
lsmWithd <- '

# factor at each time point with same loading
withd1 =~ withdW1S1        + a * withdW1S2 +
          peer * withdW1P1 + aa * withdW1P2

withd2 =~ withdW2S1        + a * withdW2S2 +
          peer * withdW2P1 + aa * withdW2P2

withd3 =~ withdW3S1        + a * withdW3S2 +
          peer * withdW3P1 + aa * withdW3P2

withd4 =~ withdW4S1        + a * withdW4S2 +
          peer * withdW4P1 + aa * withdW4P2

# structural paths between time points
withd4 ~ withd3
withd3 ~ withd2
withd2 ~ withd1

# error covariance - similar parcels across waves
withdW1S1 ~~ withdW2S1 + withdW3S1 + withdW4S1
withdW2S1 ~~ withdW3S1 + withdW4S1
```

```
withdW3S1 ~~ withdW4S1

withdW1S2 ~~ withdW2S2 + withdW3S2 + withdW4S2
withdW2S2 ~~ withdW3S2 + withdW4S2
withdW3S2 ~~ withdW4S2

withdW1P1 ~~ withdW2P1 + withdW3P1 + withdW4P1
withdW2P1 ~~ withdW3P1 + withdW4P1
withdW3P1 ~~ withdW4P1

withdW1P2 ~~ withdW2P2 + withdW3P2 + withdW4P2
withdW2P2 ~~ withdW3P2 + withdW4P2
withdW3P2 ~~ withdW4P2

# error covariance - same method at one wave
withdW1S1 ~~ withdW1S2
withdW1P1 ~~ withdW1P2
withdW2S1 ~~ withdW2S2
withdW2P1 ~~ withdW2P2
withdW3S1 ~~ withdW3S2
withdW3P1 ~~ withdW3P2
withdW4S1 ~~ withdW4S2
withdW4P1 ~~ withdW4P2
'
lsmWithd <- sem(lsmWithd, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lsmWithd, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 145 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        52
##
## Model Test User Model:
##
##   Test statistic                               308.848
##   Degrees of freedom                                78
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              2333.668
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
```

```
##
##   Comparative Fit Index (CFI)                        0.896
##   Tucker-Lewis Index (TLI)                           0.840
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1786.107
##   Loglikelihood unrestricted model (H1)      -1631.683
##
##   Akaike (AIC)                                3720.214
##   Bayesian (BIC)                              3983.420
##   Sample-size adjusted Bayesian (BIC)         3748.813
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                           0.107
##   90 Percent confidence interval - lower          0.095
##   90 Percent confidence interval - upper          0.120
##   P-value RMSEA <= 0.05                           0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                            0.165
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##   withd1 =~
##     wthW1S1              1.000                                     1.000    1.000
##     wthW1S2     (a)      0.928    0.067   13.860    0.000     0.796    1.059
##     wthW1P1  (peer)      0.712    0.252    2.822    0.005     0.217    1.207
##     wthW1P2    (aa)      0.686    0.246    2.794    0.005     0.205    1.168
##   withd2 =~
##     wthW2S1              1.000                                     1.000    1.000
##     wthW2S2     (a)      0.928    0.067   13.860    0.000     0.796    1.059
##     wthW2P1  (peer)      0.712    0.252    2.822    0.005     0.217    1.207
##     wthW2P2    (aa)      0.686    0.246    2.794    0.005     0.205    1.168
##   withd3 =~
##     wthW3S1              1.000                                     1.000    1.000
##     wthW3S2     (a)      0.928    0.067   13.860    0.000     0.796    1.059
##     wthW3P1  (peer)      0.712    0.252    2.822    0.005     0.217    1.207
##     wthW3P2    (aa)      0.686    0.246    2.794    0.005     0.205    1.168
##   withd4 =~
##     wthW4S1              1.000                                     1.000    1.000
##     wthW4S2     (a)      0.928    0.067   13.860    0.000     0.796    1.059
##     wthW4P1  (peer)      0.712    0.252    2.822    0.005     0.217    1.207
##     wthW4P2    (aa)      0.686    0.246    2.794    0.005     0.205    1.168
##    Std.lv   Std.all
##
```

```
##    0.536    0.708
##    0.497    0.687
##    0.381    0.570
##    0.367    0.524
##
##    0.593    0.772
##    0.550    0.758
##    0.422    0.626
##    0.407    0.615
##
##    0.544    0.723
##    0.505    0.737
##    0.388    0.556
##    0.374    0.566
##
##    0.547    0.722
##    0.507    0.753
##    0.389    0.578
##    0.375    0.583
##
## Regressions:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   withd4 ~
##     withd3            0.976    0.067   14.644    0.000    0.846    1.107
##   withd3 ~
##     withd2            0.885    0.056   15.946    0.000    0.777    0.994
##   withd2 ~
##     withd1            1.151    0.131    8.808    0.000    0.895    1.408
##    Std.lv  Std.all
##
##    0.972    0.972
##
##    0.964    0.964
##
##    1.040    1.040
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .withdW1S1 ~~
##     .withdW2S1        0.062    0.039    1.593    0.111   -0.014    0.138
##     .withdW3S1        0.073    0.044    1.654    0.098   -0.014    0.160
##     .withdW4S1        0.081    0.041    2.001    0.045    0.002    0.161
##   .withdW2S1 ~~
##     .withdW3S1        0.100    0.059    1.706    0.088   -0.015    0.215
##     .withdW4S1        0.080    0.052    1.546    0.122   -0.021    0.181
##   .withdW3S1 ~~
##     .withdW4S1        0.108    0.060    1.788    0.074   -0.010    0.226
##   .withdW1S2 ~~
##     .withdW2S2        0.100    0.038    2.658    0.008    0.026    0.175
##     .withdW3S2        0.111    0.035    3.139    0.002    0.042    0.181
##     .withdW4S2        0.092    0.035    2.627    0.009    0.023    0.160
##   .withdW2S2 ~~
##     .withdW3S2        0.102    0.038    2.671    0.008    0.027    0.176
##     .withdW4S2        0.095    0.038    2.492    0.013    0.020    0.170
```

```
## .withdW3S2 ~~
##    .withdW4S2       0.115    0.039    2.943    0.003    0.038    0.191
## .withdW1P1 ~~
##    .withdW2P1       0.128    0.089    1.442    0.149   -0.046    0.303
##    .withdW3P1       0.168    0.111    1.510    0.131   -0.050    0.387
##    .withdW4P1       0.151    0.088    1.716    0.086   -0.021    0.323
## .withdW2P1 ~~
##    .withdW3P1       0.191    0.100    1.906    0.057   -0.005    0.387
##    .withdW4P1       0.171    0.089    1.920    0.055   -0.004    0.345
## .withdW3P1 ~~
##    .withdW4P1       0.184    0.115    1.602    0.109   -0.041    0.408
## .withdW1P2 ~~
##    .withdW2P2       0.178    0.085    2.089    0.037    0.011    0.345
##    .withdW3P2       0.197    0.103    1.915    0.056   -0.005    0.398
##    .withdW4P2       0.134    0.094    1.428    0.153   -0.050    0.318
## .withdW2P2 ~~
##    .withdW3P2       0.192    0.095    2.028    0.043    0.006    0.377
##    .withdW4P2       0.110    0.084    1.314    0.189   -0.054    0.275
## .withdW3P2 ~~
##    .withdW4P2       0.174    0.100    1.741    0.082   -0.022    0.370
## .withdW1S1 ~~
##    .withdW1S2       0.118    0.038    3.062    0.002    0.042    0.193
## .withdW1P1 ~~
##    .withdW1P2       0.099    0.033    2.970    0.003    0.034    0.164
## .withdW2S1 ~~
##    .withdW2S2       0.060    0.022    2.745    0.006    0.017    0.103
## .withdW2P1 ~~
##    .withdW2P2       0.031    0.019    1.629    0.103   -0.006    0.069
## .withdW3S1 ~~
##    .withdW3S2       0.041    0.018    2.311    0.021    0.006    0.076
## .withdW3P1 ~~
##    .withdW3P2       0.029    0.034    0.855    0.393   -0.037    0.095
## .withdW4S1 ~~
##    .withdW4S2       0.039    0.032    1.211    0.226   -0.024    0.102
## .withdW4P1 ~~
##    .withdW4P2       0.097    0.036    2.701    0.007    0.026    0.167
##    Std.lv  Std.all
##
##    0.062    0.237
##    0.073    0.263
##    0.081    0.290
##
##    0.100    0.393
##    0.080    0.312
##
##    0.108    0.397
##
##    0.100    0.404
##    0.111    0.458
##    0.092    0.393
##
##    0.102    0.464
##    0.095    0.452
##
```

```
##     0.115    0.560
##
##     0.128    0.443
##     0.168    0.528
##     0.151    0.499
##
##     0.191    0.626
##     0.171    0.590
##
##     0.184    0.577
##
##     0.178    0.572
##     0.197    0.605
##     0.134    0.429
##
##     0.192    0.675
##     0.110    0.404
##
##     0.174    0.611
##
##     0.118    0.420
##
##     0.099    0.302
##
##     0.060    0.259
##
##     0.031    0.113
##
##     0.041    0.172
##
##     0.029    0.092
##
##     0.039    0.167
##
##     0.097    0.336
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .withdW1S1        2.970    0.047   63.127    0.000    2.878    3.062
##     .withdW1S2        3.020    0.045   67.177    0.000    2.932    3.108
##     .withdW1P1        2.587    0.052   50.128    0.000    2.486    2.688
##     .withdW1P2        2.484    0.054   45.855    0.000    2.378    2.590
##     .withdW2S1        3.015    0.051   58.761    0.000    2.915    3.116
##     .withdW2S2        3.042    0.048   63.305    0.000    2.948    3.136
##     .withdW2P1        2.602    0.052   49.642    0.000    2.499    2.704
##     .withdW2P2        2.538    0.051   49.318    0.000    2.437    2.639
##     .withdW3S1        2.950    0.051   57.887    0.000    2.850    3.050
##     .withdW3S2        3.041    0.046   66.672    0.000    2.952    3.130
##     .withdW3P1        2.613    0.056   46.731    0.000    2.504    2.723
##     .withdW3P2        2.584    0.052   49.595    0.000    2.482    2.686
##     .withdW4S1        2.942    0.055   53.698    0.000    2.835    3.050
##     .withdW4S2        2.979    0.048   62.547    0.000    2.886    3.072
##     .withdW4P1        2.641    0.058   45.178    0.000    2.526    2.756
##     .withdW4P2        2.595    0.058   44.617    0.000    2.481    2.709
```

```
##    withd1           0.000                              0.000   0.000
##   .withd2           0.000                              0.000   0.000
##   .withd3           0.000                              0.000   0.000
##   .withd4           0.000                              0.000   0.000
##   Std.lv  Std.all
##    2.970   3.926
##    3.020   4.177
##    2.587   3.864
##    2.484   3.545
##    3.015   3.926
##    3.042   4.191
##    2.602   3.854
##    2.538   3.835
##    2.950   3.919
##    3.041   4.441
##    2.613   3.749
##    2.584   3.913
##    2.942   3.886
##    2.979   4.419
##    2.641   3.921
##    2.595   4.032
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##    0.000   0.000
##
## Variances:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .withdW1S1        0.285    0.060    4.721    0.000    0.167    0.404
##   .withdW1S2        0.276    0.058    4.767    0.000    0.162    0.389
##   .withdW1P1        0.303    0.071    4.277    0.000    0.164    0.442
##   .withdW1P2        0.356    0.080    4.435    0.000    0.199    0.513
##   .withdW2S1        0.238    0.066    3.603    0.000    0.109    0.368
##   .withdW2S2        0.224    0.052    4.350    0.000    0.123    0.325
##   .withdW2P1        0.277    0.088    3.151    0.002    0.105    0.450
##   .withdW2P2        0.272    0.088    3.087    0.002    0.099    0.445
##   .withdW3S1        0.270    0.077    3.516    0.000    0.120    0.421
##   .withdW3S2        0.214    0.046    4.649    0.000    0.124    0.304
##   .withdW3P1        0.336    0.109    3.077    0.002    0.122    0.549
##   .withdW3P2        0.297    0.099    2.991    0.003    0.102    0.491
##   .withdW4S1        0.274    0.075    3.633    0.000    0.126    0.422
##   .withdW4S2        0.197    0.054    3.650    0.000    0.091    0.303
##   .withdW4P1        0.302    0.083    3.658    0.000    0.140    0.464
##   .withdW4P2        0.274    0.073    3.730    0.000    0.130    0.417
##    withd1           0.287    0.083    3.457    0.001    0.124    0.449
##   .withd2          -0.029    0.035   -0.806    0.420   -0.098    0.041
##   .withd3           0.021    0.016    1.258    0.208   -0.012    0.053
##   .withd4           0.017    0.030    0.549    0.583   -0.043    0.076
##   Std.lv  Std.all
##    0.285   0.499
##    0.276   0.528
##    0.303   0.676
##    0.356   0.725
##    0.238   0.404
```
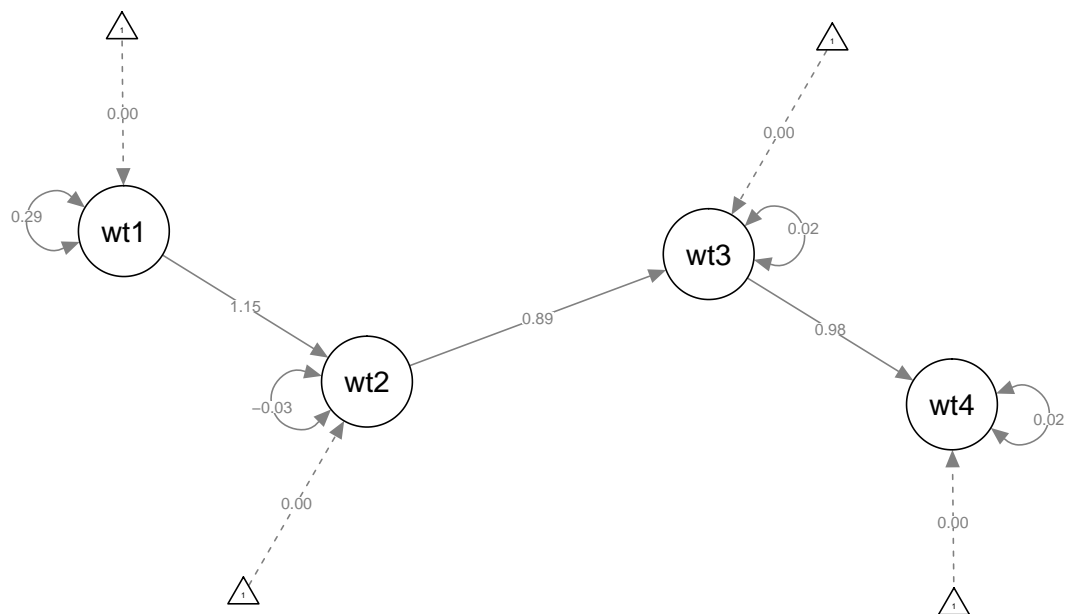
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```
##      0.224     0.426
##      0.277     0.609
##      0.272     0.622
##      0.270     0.477
##      0.214     0.456
##      0.336     0.691
##      0.297     0.680
##      0.274     0.478
##      0.197     0.434
##      0.302     0.666
##      0.274     0.660
##      1.000     1.000
##     -0.081    -0.081
##      0.070     0.070
##      0.056     0.056
```

```
semPaths(lsmWithd, what = "col", whatLabels = "est", structural = T, layout = "spring")
```


LSM Confusion

```
lsmConfu <- '

# factor at each time point with same loading
confu1 =~ confuW1S1        + a * confuW1S2 +
          peer * confuW1P1 + aa * confuW1P2
```

```
confu2 =~ confuW2S1        + a * confuW2S2 +
          peer * confuW2P1 + aa * confuW2P2

confu3 =~ confuW3S1        + a * confuW3S2 +
          peer * confuW3P1 + aa * confuW3P2

confu4 =~ confuW4S1        + a * confuW4S2 +
          peer * confuW4P1 + aa * confuW4P2

# structural paths between time points
confu4 ~ confu3
confu3 ~ confu2
confu2 ~ confu1

# error covariance - similar parcels across waves
confuW1S1 ~~ confuW2S1 + confuW3S1 + confuW4S1
confuW2S1 ~~ confuW3S1 + confuW4S1
confuW3S1 ~~ confuW4S1

confuW1S2 ~~ confuW2S2 + confuW3S2 + confuW4S2
confuW2S2 ~~ confuW3S2 + confuW4S2
confuW3S2 ~~ confuW4S2

confuW1P1 ~~ confuW2P1 + confuW3P1 + confuW4P1
confuW2P1 ~~ confuW3P1 + confuW4P1
confuW3P1 ~~ confuW4P1

confuW1P2 ~~ confuW2P2 + confuW3P2 + confuW4P2
confuW2P2 ~~ confuW3P2 + confuW4P2
confuW3P2 ~~ confuW4P2

# error covariance - same method at one wave
confuW1S1 ~~ confuW1S2
confuW1P1 ~~ confuW1P2
confuW2S1 ~~ confuW2S2
confuW2P1 ~~ confuW2P2
confuW3S1 ~~ confuW3S2
confuW3P1 ~~ confuW3P2
confuW4S1 ~~ confuW4S2
confuW4P1 ~~ confuW4P2
'
lsmConfu <- sem(lsmConfu, data = data, missing = "ML")

## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative

summary(lsmConfu, fit.measures = T, standardized = T, ci = T)

## lavaan 0.6-7 ended normally after 101 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
```

```
##
##    Number of observations                         259
##    Number of missing patterns                       55
##
## Model Test User Model:
##
##    Test statistic                              154.307
##    Degrees of freedom                               78
##    P-value (Chi-square)                          0.000
##
## Model Test Baseline Model:
##
##    Test statistic                             1406.278
##    Degrees of freedom                              120
##    P-value                                       0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                   0.941
##    Tucker-Lewis Index (TLI)                      0.909
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)             -2220.262
##    Loglikelihood unrestricted model (H1)     -2143.108
##
##    Akaike (AIC)                               4588.523
##    Bayesian (BIC)                             4851.729
##    Sample-size adjusted Bayesian (BIC)        4617.122
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                         0.061
##    90 Percent confidence interval - lower        0.047
##    90 Percent confidence interval - upper        0.076
##    P-value RMSEA <= 0.05                         0.091
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                          0.107
##
## Parameter Estimates:
##
##    Standard errors                            Standard
##    Information                                Observed
##    Observed information based on               Hessian
##
## Latent Variables:
##                 Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    confu1 =~
##      cnfW1S1          1.000                                    1.000    1.000
##      cnfW1S2    (a)   1.093    0.112    9.753    0.000    0.874    1.313
##      cnfW1P1 (peer)   0.975    0.167    5.824    0.000    0.647    1.303
##      cnfW1P2   (aa)   0.756    0.145    5.209    0.000    0.471    1.040
```

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```
## confu2 =~
##   cnfW2S1                1.000                                1.000   1.000
##   cnfW2S2      (a)       1.093    0.112    9.753    0.000      0.874   1.313
##   cnfW2P1 (peer)         0.975    0.167    5.824    0.000      0.647   1.303
##   cnfW2P2     (aa)       0.756    0.145    5.209    0.000      0.471   1.040
## confu3 =~
##   cnfW3S1                1.000                                1.000   1.000
##   cnfW3S2      (a)       1.093    0.112    9.753    0.000      0.874   1.313
##   cnfW3P1 (peer)         0.975    0.167    5.824    0.000      0.647   1.303
##   cnfW3P2     (aa)       0.756    0.145    5.209    0.000      0.471   1.040
## confu4 =~
##   cnfW4S1                1.000                                1.000   1.000
##   cnfW4S2      (a)       1.093    0.112    9.753    0.000      0.874   1.313
##   cnfW4P1 (peer)         0.975    0.167    5.824    0.000      0.647   1.303
##   cnfW4P2     (aa)       0.756    0.145    5.209    0.000      0.471   1.040
##   Std.lv  Std.all
##
##   0.408    0.526
##   0.446    0.577
##   0.397    0.471
##   0.308    0.476
##
##   0.457    0.619
##   0.500    0.639
##   0.446    0.619
##   0.346    0.520
##
##   0.507    0.639
##   0.554    0.654
##   0.494    0.676
##   0.383    0.560
##
##   0.428    0.571
##   0.468    0.601
##   0.417    0.572
##   0.324    0.449
##
## Regressions:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   confu4 ~
##     confu3            0.835    0.084    9.972    0.000    0.671    1.000
##   confu3 ~
##     confu2            1.029    0.092   11.196    0.000    0.849    1.209
##   confu2 ~
##     confu1            1.283    0.214    5.994    0.000    0.863    1.702
##   Std.lv  Std.all
##
##   0.990    0.990
##
##   0.928    0.928
##
##   1.143    1.143
##
## Covariances:
```

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```
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower ci.upper
##  .confuW1S1 ~~
##     .confuW2S1        0.087    0.032    2.722    0.006     0.024    0.149
##     .confuW3S1        0.085    0.032    2.675    0.007     0.023    0.148
##     .confuW4S1        0.125    0.034    3.644    0.000     0.058    0.193
##  .confuW2S1 ~~
##     .confuW3S1        0.101    0.034    2.936    0.003     0.034    0.168
##     .confuW4S1        0.118    0.035    3.421    0.001     0.051    0.186
##  .confuW3S1 ~~
##     .confuW4S1        0.130    0.036    3.616    0.000     0.060    0.201
##  .confuW1S2 ~~
##     .confuW2S2        0.081    0.036    2.274    0.023     0.011    0.150
##     .confuW3S2        0.062    0.034    1.832    0.067    -0.004    0.129
##     .confuW4S2        0.037    0.037    0.999    0.318    -0.035    0.109
##  .confuW2S2 ~~
##     .confuW3S2        0.156    0.041    3.858    0.000     0.077    0.236
##     .confuW4S2        0.107    0.043    2.497    0.013     0.023    0.191
##  .confuW3S2 ~~
##     .confuW4S2        0.140    0.045    3.089    0.002     0.051    0.229
##  .confuW1P1 ~~
##     .confuW2P1        0.187    0.053    3.504    0.000     0.082    0.291
##     .confuW3P1        0.200    0.052    3.852    0.000     0.098    0.302
##     .confuW4P1        0.158    0.060    2.627    0.009     0.040    0.276
##  .confuW2P1 ~~
##     .confuW3P1        0.140    0.050    2.833    0.005     0.043    0.237
##     .confuW4P1        0.158    0.055    2.876    0.004     0.050    0.266
##  .confuW3P1 ~~
##     .confuW4P1        0.168    0.054    3.138    0.002     0.063    0.273
##  .confuW1P2 ~~
##     .confuW2P2        0.157    0.039    3.995    0.000     0.080    0.235
##     .confuW3P2        0.121    0.038    3.168    0.002     0.046    0.196
##     .confuW4P2        0.221    0.047    4.728    0.000     0.130    0.313
##  .confuW2P2 ~~
##     .confuW3P2        0.191    0.043    4.417    0.000     0.106    0.275
##     .confuW4P2        0.225    0.047    4.754    0.000     0.133    0.318
##  .confuW3P2 ~~
##     .confuW4P2        0.187    0.048    3.914    0.000     0.093    0.280
##  .confuW1S1 ~~
##     .confuW1S2        0.155    0.039    3.933    0.000     0.078    0.232
##  .confuW1P1 ~~
##     .confuW1P2        0.121    0.035    3.477    0.001     0.053    0.190
##  .confuW2S1 ~~
##     .confuW2S2        0.057    0.026    2.175    0.030     0.006    0.108
##  .confuW2P1 ~~
##     .confuW2P2        0.032    0.023    1.421    0.155    -0.012    0.077
##  .confuW3S1 ~~
##     .confuW3S2        0.124    0.032    3.832    0.000     0.061    0.188
##  .confuW3P1 ~~
##     .confuW3P2        0.055    0.027    2.016    0.044     0.002    0.108
##  .confuW4S1 ~~
##     .confuW4S2        0.095    0.046    2.064    0.039     0.005    0.185
##  .confuW4P1 ~~
##     .confuW4P2        0.058    0.039    1.501    0.133    -0.018    0.134
##    Std.lv  Std.all
```

```
## 
##      0.087    0.226
##      0.085    0.212
##      0.125    0.309
## 
##      0.101    0.285
##      0.118    0.331
## 
##      0.130    0.347
## 
##      0.081    0.213
##      0.062    0.154
##      0.037    0.093
## 
##      0.156    0.405
##      0.107    0.285
## 
##      0.140    0.351
## 
##      0.187    0.444
##      0.200    0.499
##      0.158    0.354
## 
##      0.140    0.460
##      0.158    0.466
## 
##      0.168    0.522
## 
##      0.157    0.485
##      0.121    0.375
##      0.221    0.603
## 
##      0.191    0.591
##      0.225    0.615
## 
##      0.187    0.510
## 
##      0.155    0.373
## 
##      0.121    0.286
## 
##      0.057    0.162
## 
##      0.032    0.100
## 
##      0.124    0.318
## 
##      0.055    0.178
## 
##      0.095    0.248
## 
##      0.058    0.151
## 
## Intercepts:
```

```
##                          Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .confuW1S1            2.900     0.048    60.229   0.000    2.805    2.994
##     .confuW1S2            2.954     0.048    61.510   0.000    2.860    3.048
##     .confuW1P1            2.489     0.069    36.322   0.000    2.355    2.623
##     .confuW1P2            2.463     0.052    47.096   0.000    2.361    2.566
##     .confuW2S1            2.806     0.051    55.408   0.000    2.706    2.905
##     .confuW2S2            2.871     0.053    53.773   0.000    2.766    2.975
##     .confuW2P1            2.349     0.058    40.330   0.000    2.235    2.463
##     .confuW2P2            2.464     0.054    45.575   0.000    2.358    2.570
##     .confuW3S1            2.737     0.055    49.707   0.000    2.629    2.845
##     .confuW3S2            2.836     0.059    48.346   0.000    2.721    2.950
##     .confuW3P1            2.458     0.060    41.042   0.000    2.340    2.575
##     .confuW3P2            2.536     0.058    43.750   0.000    2.422    2.649
##     .confuW4S1            2.810     0.056    50.130   0.000    2.700    2.920
##     .confuW4S2            2.734     0.059    46.302   0.000    2.618    2.849
##     .confuW4P1            2.493     0.068    36.565   0.000    2.359    2.626
##     .confuW4P2            2.525     0.066    38.220   0.000    2.395    2.654
##      confu1               0.000                                0.000    0.000
##     .confu2               0.000                                0.000    0.000
##     .confu3               0.000                                0.000    0.000
##     .confu4               0.000                                0.000    0.000
##    Std.lv  Std.all
##     2.900   3.742
##     2.954   3.822
##     2.489   2.951
##     2.463   3.801
##     2.806   3.794
##     2.871   3.666
##     2.349   3.259
##     2.464   3.702
##     2.737   3.449
##     2.836   3.346
##     2.458   3.362
##     2.536   3.701
##     2.810   3.749
##     2.734   3.510
##     2.493   3.415
##     2.525   3.500
##     0.000   0.000
##     0.000   0.000
##     0.000   0.000
##     0.000   0.000
##
## Variances:
##                          Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .confuW1S1            0.434     0.050    8.676    0.000    0.336    0.532
##     .confuW1S2            0.399     0.051    7.867    0.000    0.299    0.498
##     .confuW1P1            0.554     0.074    7.455    0.000    0.408    0.699
##     .confuW1P2            0.325     0.043    7.478    0.000    0.240    0.410
##     .confuW2S1            0.338     0.044    7.617    0.000    0.251    0.424
##     .confuW2S2            0.363     0.051    7.117    0.000    0.263    0.463
##     .confuW2P1            0.321     0.057    5.644    0.000    0.209    0.432
##     .confuW2P2            0.323     0.047    6.914    0.000    0.232    0.415
##     .confuW3S1            0.372     0.052    7.176    0.000    0.271    0.474
```

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```
##     .confuW3S2          0.411    0.056    7.286    0.000    0.300    0.521
##     .confuW3P1          0.290    0.055    5.315    0.000    0.183    0.397
##     .confuW3P2          0.322    0.050    6.420    0.000    0.224    0.421
##     .confuW4S1          0.378    0.054    7.013    0.000    0.273    0.484
##     .confuW4S2          0.388    0.077    5.054    0.000    0.237    0.538
##     .confuW4P1          0.359    0.068    5.300    0.000    0.226    0.491
##     .confuW4P2          0.416    0.068    6.081    0.000    0.282    0.550
##      confu1             0.166    0.045    3.655    0.000    0.077    0.255
##     .confu2            -0.064    0.042   -1.547    0.122   -0.146    0.017
##     .confu3             0.036    0.022    1.620    0.105   -0.008    0.079
##     .confu4             0.004    0.034    0.113    0.910   -0.062    0.070
##    Std.lv   Std.all
##    0.434    0.723
##    0.399    0.667
##    0.554    0.778
##    0.325    0.774
##    0.338    0.617
##    0.363    0.592
##    0.321    0.617
##    0.323    0.730
##    0.372    0.591
##    0.411    0.572
##    0.290    0.543
##    0.322    0.687
##    0.378    0.674
##    0.388    0.639
##    0.359    0.673
##    0.416    0.799
##    1.000    1.000
##   -0.307   -0.307
##    0.139    0.139
##    0.021    0.021
```

```r
semPaths(lsmConfu, what = "col", whatLabels = "est", structural = T, layout = "spring")
```
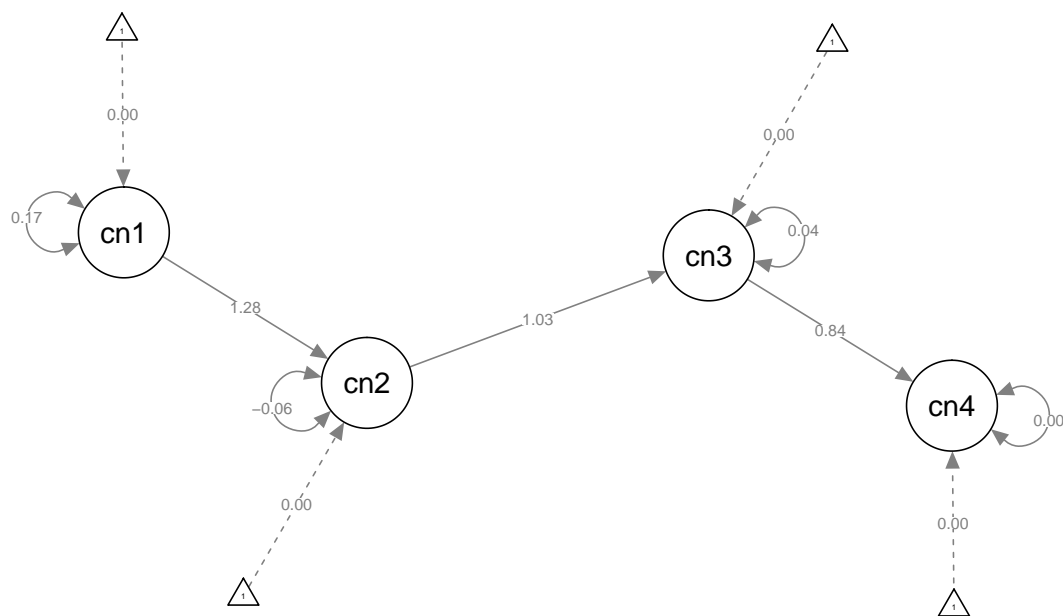
LSM Coherence

```
lsmCoher <- '

# factor at each time point with same loading
coher1 =~ coherW1S1        + a * coherW1S2 +
          peer * coherW1P1 + aa * coherW1P2

coher2 =~ coherW2S1        + a * coherW2S2 +
          peer * coherW2P1 + aa * coherW2P2

coher3 =~ coherW3S1        + a * coherW3S2 +
          peer * coherW3P1 + aa * coherW3P2

coher4 =~ coherW4S1        + a * coherW4S2 +
          peer * coherW4P1 + aa * coherW4P2

# structural paths between time points
coher4 ~ coher3
coher3 ~ coher2
coher2 ~ coher1

# error covariance - similar parcels across waves
coherW1S1 ~~ coherW2S1 + coherW3S1 + coherW4S1
coherW2S1 ~~ coherW3S1 + coherW4S1
```

```
coherW3S1 ~~ coherW4S1

coherW1S2 ~~ coherW2S2 + coherW3S2 + coherW4S2
coherW2S2 ~~ coherW3S2 + coherW4S2
coherW3S2 ~~ coherW4S2

coherW1P1 ~~ coherW2P1 + coherW3P1 + coherW4P1
coherW2P1 ~~ coherW3P1 + coherW4P1
coherW3P1 ~~ coherW4P1

coherW1P2 ~~ coherW2P2 + coherW3P2 + coherW4P2
coherW2P2 ~~ coherW3P2 + coherW4P2
coherW3P2 ~~ coherW4P2

# error covariance - same method at one wave
coherW1S1 ~~ coherW1S2
coherW1P1 ~~ coherW1P2
coherW2S1 ~~ coherW2S2
coherW2P1 ~~ coherW2P2
coherW3S1 ~~ coherW3S2
coherW3P1 ~~ coherW3P2
coherW4S1 ~~ coherW4S2
coherW4P1 ~~ coherW4P2
'
lsmCoher <- sem(lsmCoher, data = data, missing = "ML")
```

```
## Warning in lav_object_post_check(object): lavaan WARNING: some estimated lv
## variances are negative
```

```
summary(lsmCoher, fit.measures = T, standardized = T, ci = T)
```

```
## lavaan 0.6-7 ended normally after 206 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         83
##   Number of equality constraints                     9
##
##   Number of observations                           259
##   Number of missing patterns                        55
##
## Model Test User Model:
##
##   Test statistic                               172.603
##   Degrees of freedom                                78
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              1489.355
##   Degrees of freedom                               120
##   P-value                                        0.000
##
## User Model versus Baseline Model:
```

```
##
##   Comparative Fit Index (CFI)                        0.931
##   Tucker-Lewis Index (TLI)                           0.894
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)             -1717.654
##   Loglikelihood unrestricted model (H1)     -1631.353
##
##   Akaike (AIC)                               3583.309
##   Bayesian (BIC)                             3846.514
##   Sample-size adjusted Bayesian (BIC)        3611.907
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.068
##   90 Percent confidence interval - lower         0.055
##   90 Percent confidence interval - upper         0.082
##   P-value RMSEA <= 0.05                          0.015
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.129
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Observed
##   Observed information based on                Hessian
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   coher1 =~
##     chrW1S1              1.000                                   1.000    1.000
##     chrW1S2     (a)      0.831    0.196    4.230    0.000    0.446    1.216
##     chrW1P1 (peer)      2.148    0.485    4.425    0.000    1.196    3.099
##     chrW1P2    (aa)      2.424    0.597    4.056    0.000    1.253    3.595
##   coher2 =~
##     chrW2S1              1.000                                   1.000    1.000
##     chrW2S2     (a)      0.831    0.196    4.230    0.000    0.446    1.216
##     chrW2P1 (peer)      2.148    0.485    4.425    0.000    1.196    3.099
##     chrW2P2    (aa)      2.424    0.597    4.056    0.000    1.253    3.595
##   coher3 =~
##     chrW3S1              1.000                                   1.000    1.000
##     chrW3S2     (a)      0.831    0.196    4.230    0.000    0.446    1.216
##     chrW3P1 (peer)      2.148    0.485    4.425    0.000    1.196    3.099
##     chrW3P2    (aa)      2.424    0.597    4.056    0.000    1.253    3.595
##   coher4 =~
##     chrW4S1              1.000                                   1.000    1.000
##     chrW4S2     (a)      0.831    0.196    4.230    0.000    0.446    1.216
##     chrW4P1 (peer)      2.148    0.485    4.425    0.000    1.196    3.099
##     chrW4P2    (aa)      2.424    0.597    4.056    0.000    1.253    3.595
##    Std.lv  Std.all
##
```

```
##    0.176    0.263
##    0.146    0.266
##    0.377    0.551
##    0.426    0.675
##
##    0.220    0.323
##    0.183    0.322
##    0.474    0.730
##    0.534    0.840
##
##    0.250    0.338
##    0.208    0.359
##    0.537    0.811
##    0.606    0.911
##
##    0.171    0.265
##    0.143    0.256
##    0.368    0.609
##    0.416    0.693
##
## Regressions:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   coher4 ~
##     coher3            0.801    0.072   11.187    0.000    0.661    0.941
##   coher3 ~
##     coher2            1.130    0.119    9.492    0.000    0.897    1.364
##   coher2 ~
##     coher1            1.219    0.329    3.706    0.000    0.574    1.864
##    Std.lv  Std.all
##
##    1.169    1.169
##
##    0.996    0.996
##
##    0.972    0.972
##
## Covariances:
##                     Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .coherW1S1 ~~
##     .coherW2S1        0.212    0.034    6.309    0.000    0.146    0.277
##     .coherW3S1        0.181    0.036    5.081    0.000    0.111    0.250
##     .coherW4S1        0.166    0.033    4.963    0.000    0.101    0.232
##   .coherW2S1 ~~
##     .coherW3S1        0.226    0.038    5.960    0.000    0.152    0.300
##     .coherW4S1        0.195    0.035    5.572    0.000    0.126    0.263
##   .coherW3S1 ~~
##     .coherW4S1        0.219    0.039    5.581    0.000    0.142    0.295
##   .coherW1S2 ~~
##     .coherW2S2        0.160    0.024    6.703    0.000    0.113    0.207
##     .coherW3S2        0.156    0.024    6.604    0.000    0.109    0.202
##     .coherW4S2        0.143    0.025    5.707    0.000    0.094    0.192
##   .coherW2S2 ~~
##     .coherW3S2        0.155    0.026    6.071    0.000    0.105    0.205
##     .coherW4S2        0.155    0.026    5.985    0.000    0.104    0.205
```

```
##   .coherW3S2 ~~
##     .coherW4S2          0.167    0.028    6.031    0.000    0.113    0.222
##   .coherW1P1 ~~
##     .coherW2P1          0.073    0.025    2.928    0.003    0.024    0.122
##     .coherW3P1          0.053    0.027    1.966    0.049    0.000    0.107
##     .coherW4P1          0.090    0.027    3.352    0.001    0.037    0.142
##   .coherW2P1 ~~
##     .coherW3P1          0.067    0.025    2.710    0.007    0.019    0.116
##     .coherW4P1          0.081    0.024    3.322    0.001    0.033    0.129
##   .coherW3P1 ~~
##     .coherW4P1          0.071    0.026    2.776    0.006    0.021    0.121
##   .coherW1P2 ~~
##     .coherW2P2         -0.001    0.025   -0.023    0.981   -0.049    0.048
##     .coherW3P2          0.007    0.027    0.267    0.790   -0.046    0.061
##     .coherW4P2          0.023    0.028    0.822    0.411   -0.031    0.077
##   .coherW2P2 ~~
##     .coherW3P2         -0.004    0.030   -0.145    0.885   -0.063    0.054
##     .coherW4P2         -0.011    0.029   -0.387    0.699   -0.067    0.045
##   .coherW3P2 ~~
##     .coherW4P2          0.011    0.032    0.363    0.716   -0.050    0.073
##   .coherW1S1 ~~
##     .coherW1S2          0.048    0.018    2.733    0.006    0.014    0.083
##   .coherW1P1 ~~
##     .coherW1P2          0.157    0.049    3.177    0.001    0.060    0.253
##   .coherW2S1 ~~
##     .coherW2S2          0.057    0.017    3.363    0.001    0.024    0.091
##   .coherW2P1 ~~
##     .coherW2P2          0.075    0.027    2.757    0.006    0.022    0.129
##   .coherW3S1 ~~
##     .coherW3S2          0.067    0.019    3.517    0.000    0.030    0.105
##   .coherW3P1 ~~
##     .coherW3P2          0.022    0.024    0.897    0.370   -0.026    0.069
##   .coherW4S1 ~~
##     .coherW4S2          0.067    0.021    3.205    0.001    0.026    0.107
##   .coherW4P1 ~~
##     .coherW4P2          0.108    0.054    1.988    0.047    0.002    0.215
##    Std.lv  Std.all
##
##    0.212    0.508
##    0.181    0.402
##    0.166    0.413
##
##    0.226    0.502
##    0.195    0.485
##
##    0.219    0.504
##
##    0.160    0.560
##    0.156    0.543
##    0.143    0.501
##
##    0.155    0.531
##    0.155    0.533
##
```

```
##     0.167     0.576
##
##     0.073     0.287
##     0.053     0.241
##     0.090     0.327
##
##     0.067     0.391
##     0.081     0.382
##
##     0.071     0.381
##
##    -0.001    -0.004
##     0.007     0.057
##     0.023     0.113
##
##    -0.004    -0.045
##    -0.011    -0.074
##
##     0.011     0.097
##
##     0.048     0.142
##
##     0.157     0.589
##
##     0.057     0.165
##
##     0.075     0.491
##
##     0.067     0.179
##
##     0.022     0.205
##
##     0.067     0.199
##
##     0.108     0.523
##
## Intercepts:
##                  Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .coherW1S1      3.467    0.042   83.407    0.000    3.386    3.549
##     .coherW1S2      3.940    0.034  115.366    0.000    3.873    4.006
##     .coherW1P1      4.029    0.058   69.705    0.000    3.915    4.142
##     .coherW1P2      3.982    0.053   75.481    0.000    3.879    4.085
##     .coherW2S1      3.513    0.047   75.235    0.000    3.421    3.604
##     .coherW2S2      3.933    0.039  101.445    0.000    3.857    4.009
##     .coherW2P1      4.022    0.053   75.518    0.000    3.918    4.127
##     .coherW2P2      4.004    0.052   76.773    0.000    3.902    4.106
##     .coherW3S1      3.504    0.052   67.753    0.000    3.403    3.606
##     .coherW3S2      3.965    0.040   99.673    0.000    3.887    4.043
##     .coherW3P1      3.956    0.055   71.591    0.000    3.848    4.065
##     .coherW3P2      3.946    0.055   72.079    0.000    3.839    4.053
##     .coherW4S1      3.518    0.049   72.067    0.000    3.422    3.614
##     .coherW4S2      4.024    0.041   97.520    0.000    3.943    4.105
##     .coherW4P1      3.932    0.054   72.396    0.000    3.826    4.039
##     .coherW4P2      3.924    0.054   72.176    0.000    3.817    4.031
```

```
##     coher1              0.000                                    0.000    0.000
##    .coher2              0.000                                    0.000    0.000
##    .coher3              0.000                                    0.000    0.000
##    .coher4              0.000                                    0.000    0.000
##    Std.lv  Std.all
##     3.467   5.183
##     3.940   7.168
##     4.029   5.879
##     3.982   6.314
##     3.513   5.149
##     3.933   6.900
##     4.022   6.198
##     4.004   6.295
##     3.504   4.737
##     3.965   6.848
##     3.956   5.970
##     3.946   5.931
##     3.518   5.448
##     4.024   7.243
##     3.932   6.509
##     3.924   6.545
##     0.000   0.000
##     0.000   0.000
##     0.000   0.000
##     0.000   0.000
##
## Variances:
##                      Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##    .coherW1S1           0.417    0.038   10.840    0.000    0.341    0.492
##    .coherW1S2           0.281    0.026   10.765    0.000    0.230    0.332
##    .coherW1P1           0.327    0.060    5.436    0.000    0.209    0.445
##    .coherW1P2           0.216    0.055    3.942    0.000    0.109    0.324
##    .coherW2S1           0.417    0.042    9.896    0.000    0.334    0.499
##    .coherW2S2           0.291    0.030    9.742    0.000    0.233    0.350
##    .coherW2P1           0.197    0.035    5.648    0.000    0.129    0.265
##    .coherW2P2           0.119    0.043    2.780    0.005    0.035    0.203
##    .coherW3S1           0.485    0.051    9.559    0.000    0.385    0.584
##    .coherW3S2           0.292    0.031    9.565    0.000    0.232    0.352
##    .coherW3P1           0.150    0.035    4.333    0.000    0.082    0.218
##    .coherW3P2           0.075    0.043    1.730    0.084   -0.010    0.160
##    .coherW4S1           0.388    0.044    8.791    0.000    0.301    0.474
##    .coherW4S2           0.288    0.033    8.797    0.000    0.224    0.353
##    .coherW4P1           0.229    0.053    4.296    0.000    0.125    0.334
##    .coherW4P2           0.187    0.069    2.714    0.007    0.052    0.322
##     coher1              0.031    0.017    1.783    0.075   -0.003    0.065
##    .coher2              0.003    0.012    0.230    0.818   -0.020    0.026
##    .coher3              0.000    0.005    0.091    0.927   -0.010    0.011
##    .coher4             -0.011    0.010   -1.059    0.290   -0.031    0.009
##    Std.lv  Std.all
##     0.417   0.931
##     0.281   0.929
##     0.327   0.697
##     0.216   0.544
##     0.417   0.896
```

```
##      0.291    0.897
##      0.197    0.468
##      0.119    0.294
##      0.485    0.886
##      0.292    0.871
##      0.150    0.343
##      0.075    0.169
##      0.388    0.930
##      0.288    0.934
##      0.229    0.629
##      0.187    0.520
##      1.000    1.000
##      0.056    0.056
##      0.008    0.008
##     -0.366   -0.366
```

```
semPaths(lsmCoher, what = "col", whatLabels = "est", structural = T, layout = "spring")
```