

# Package ‘semptools’

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**Title** Customizing Structural Equation Modelling Plots

**Version** 0.2.9.11

**Description** Most function focus on specific ways to customize a graph. They use a 'qgraph' output as the first argument, and return a modified 'qgraph' object. This allows the functions to be chained by a pipe operator.

**URL** <https://sfcheung.github.io/semptools/>

**BugReports** <https://github.com/sfcheung/semptools/issues>

**Depends** R (>= 3.6.0)

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**Imports** dplyr, lavaan, rlang, semPlot

**Suggests** testthat (>= 2.1.0), knitr, rmarkdown, magrittr

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**VignetteBuilder** knitr

**NeedsCompilation** no

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## R topics documented:

cfa_example . . . . .	2
change_node_label . . . . .	3
is_dv_residvar . . . . .	4
keep_drop_nodes . . . . .	5

layout_matrix . . . . .	7
mark_se . . . . .	8
mark_sig . . . . .	9
pa_example . . . . .	11
pa_example_3covs . . . . .	12
rotate_resid . . . . .	13
sem_2nd_order_example . . . . .	14
sem_example . . . . .	15
set_cfa_layout . . . . .	15
set_curve . . . . .	17
set_edge_label_position . . . . .	19
set_sem_layout . . . . .	20
to_list_of_lists . . . . .	23

<b>Index</b>	<b>25</b>
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cfa_example	<i>Sample dataset pa_example</i>
-------------	----------------------------------

---

## Description

A sample dataset for fitting a confirmatory factor analysis model.

## Usage

```
cfa_example
```

## Format

An object of class `data.frame` with 200 rows and 14 columns.

## Details

Fourteen variables (x01 to x14), 200 cases.

Sample model to fit (in `lavaan::model.syntax` notation)

```
mod <-
'f1 =~ x01 + x02 + x03
f2 =~ x04 + x05 + x06 + x07
f3 =~ x08 + x09 + x10
f4 =~ x11 + x12 + x13 + x14
'
```

---

change\_node\_label      *Change node labels*

---

### Description

Change the labels of selected nodes.

### Usage

```
change_node_label(
  semPaths_plot,
  label_list = NULL,
  label.cex,
  label.scale,
  label.prop,
  label.norm
)
```

### Arguments

- |               |   |
|---------------|---|
| semPaths_plot | A <a href="#">qgraph::qgraph</a> object generated by <a href="#">semPlot::semPaths</a> , or a similar qgraph object modified by other <a href="#">semptools</a> functions.  |
| label_list    | A list of named lists. Each named list should have two named values: node and to. The first part, node, is a character denoting the label to be changed. It should be as appeared in the qgraph. The second part, to, is the new label. Expression can be used in to. A named vector can also be used, with the names being the nodes to be changed, and the values the new labels. |
| label.cex     | Identical to the same argument in <a href="#">semPlot::semPaths()</a> . A number tha control the size of labels in the nodes. It has no default. If not set, then this option in the semPaths_plot will not be changed.   |
| label.scale   | Identical to the same argument in <a href="#">semPlot::semPaths</a> . A logical value that determine whether labels will be scaled (resized) to the nodes they attach to. It has no default. If not set, then this option in the semPaths_plot will not be changed.   |
| label.prop    | Identical to the same argument in <a href="#">semPlot::semPaths</a> . A numeric vector of length equal to the number of nodes. If label.scale is TRUE, this number is the proportion of the width of a node that its label will be scaled (resized) to. It has no default. If not set, then this option in the semPaths_plot will not be changed.                                   |
| label.norm    | Identical to the same argument in <a href="#">semPlot::semPaths</a> . It must be a string. All labels as wide as or narrower than this string will have the same font size, while all labels wider than this string will be rescaled to have the same width as this string. It has no default. If not set, then this option in the semPaths_plot will not be changed.               |

## Details

Modify a `qgraph::qgraph` object generated by `semPlot::semPaths` and change the labels of selected nodes.

`change_node_label2()` is an experimental version that takes a named list as input.

## Value

A `qgraph::qgraph` based on the original one, with node attributes of selected nodes modified.

## Examples

```
library(semPlot)
library(lavaan)
mod_pa <-
  'x1 ~~ x2
  x3 ~ x1 + x2
  x4 ~ x1 + x3
  '
fit_pa <- sem(mod_pa, pa_example)
parameterEstimates(fit_pa)[, c("lhs", "op", "rhs", "est", "pvalue")]
m <- matrix(c("x1", NA, NA,
             NA, "x3", "x4",
             "x2", NA, NA), byrow = TRUE, 3, 3)
p_pa <- semPaths(fit_pa, whatLabels="est",
                style = "ram",
                nCharNodes = 0, nCharEdges = 0,
                layout = m)

my_label_list <- list(list(node = "x3", to = "mediator"),
                     list(node = "x4", to = expression(gamma)))

p_pa2 <- change_node_label(p_pa, my_label_list)
plot(p_pa2)
```

---

is\_dv\_residvar

*Identify dependent Variable residual variance*

---

## Description

Check which parameters in a lavaan output are the residual variance of a dependent variable.

## Usage

```
is_dv_residvar(lavaan_out)
```

## Arguments

lavaan\_out      A `lavaan::lavaan` object.

**Details**

Check which parameters in a lavaan output are the variance of a dependent variable. Indicators of a latent variable will be excluded.

**Value**

A boolean vector with length equal to the number of rows in the lavaan output.

**Examples**

```

mod <-
'x1 ~~ x2
 x3 ~ x1 + x2
 x4 ~ x1 + x3
'
fit_pa <- lavaan::sem(mod, pa_example)
is_dv_residvar(fit_pa)

mod <-
'f1 =~ x01 + x02 + x03
 f2 =~ x04 + x05 + x06 + x07
 f3 =~ x08 + x09 + x10
 f4 =~ x11 + x12 + x13 + x14
'
fit_cfa <- lavaan::cfa(mod, cfa_example)
is_dv_residvar(fit_cfa)

mod <-
'f1 =~ x01 + x02 + x03
 f2 =~ x04 + x05 + x06 + x07
 f3 =~ x08 + x09 + x10
 f4 =~ x11 + x12 + x13 + x14
 f3 ~ f1 + f2
 f4 ~ f1 + f3
'
fit_sem <- lavaan::sem(mod, sem_example)
is_dv_residvar(fit_sem)

```

---

keep\_drop\_nodes

*Keep or drop nodes*


---

**Description**

Keep or drop nodes from an semPlotModel object.

**Usage**

```
drop_nodes(object, nodes)
```

```
keep_nodes(object, nodes)
```

**Arguments**

`object` An an `semPlot::semPlotModel` generated by `semPlot::semPlotModel()`.

`nodes` A character vector of the nodes to be kept or removed.

**Details**

These functions can be used to edit the nodes in an `semPlot::semPlotModel` generated by `semPlot::semPlotModel()`. The edited object can then be passed to `semPlot::semPaths()` to generate a path diagram.

Use `keep_nodes()` to specify the nodes to be kept. All other nodes will be removed.

Use `drop_nodes()` to specify the nodes to be dropped. All other nodes will be kept.

**Value**

An object of the class `semPlot::semPlotModel`.

**Examples**

```
mod_pa <-
  'x1 ~~ x2
  x3 ~ x1 + x2
  x4 ~ x1 + x3
  '

fit_pa <- lavaan::sem(mod_pa, pa_example)
m <- matrix(c("x1", NA, NA,
              NA, "x3", "x4",
              "x2", NA, NA), byrow = TRUE, 3, 3)
pm_pa <- semPlot::semPlotModel(fit_pa)
semPlot::semPaths(pm_pa, whatLabels = "est",
                  style = "ram",
                  nCharNodes = 0, nCharEdges = 0,
                  layout = m)
pm_pa2 <- drop_nodes(pm_pa, c("x3"))
semPlot::semPaths(pm_pa2, whatLabels = "est",
                  style = "ram",
                  nCharNodes = 0, nCharEdges = 0,
                  layout = m)
pm_pa3 <- keep_nodes(pm_pa, c("x1", "x3", "x4"))
semPlot::semPaths(pm_pa3, whatLabels = "est",
                  style = "ram",
                  nCharNodes = 0, nCharEdges = 0,
                  layout = m)
```

---

layout_matrix	<i>Create the layout matrix for semPaths</i>
---------------	--

---

## Description

Create the layout matrix from a list of coordinates for `semPaths`.

## Usage

```
layout_matrix(...)
```

## Arguments

... Each node in the matrix is specified by this form: `name = c(x, y)`. The name is the node label, and the vector is the position of the node. The first element is the x position, and the second element is the y position, measured from the top left corner. The size of the grid is determined automatically. For a grid of n rows and m columns, the top left cell is specified by `c(1, 1)`, and the bottom right cell is specified by `c(n, m)`.

## Details

The layout argument in `semPlot::semPaths()` accepts a matrix with node labels as the elements, and NA for empty cells. This function allows user to create the matrix using a list of coordinates for the node labels.

## Value

A layout matrix for the layout argument of `semPlot::semPaths()`.

## Examples

```
# Suppose this is the layout to be created:
m0 <- matrix(c("x1", NA, NA, NA,
              "x2", "x3", NA, NA,
              NA, "x4", NA, "x5"), byrow = TRUE, 3, 4)
# This call will create the same matrix.
m1 <- layout_matrix(x1 = c(1, 1),
                  x2 = c(2, 1),
                  x3 = c(2, 2),
                  x4 = c(3, 2),
                  x5 = c(3, 4))
#The two matrices should be identical.
m0 == m1
```

---

 mark\_se

*Add Standard Error Estimates to Parameter Estimates (Edge Labels)*


---

## Description

Add standard error estimates, in parentheses, to parameter estimates (edge labels) in a `qgraph::qgraph` object.

## Usage

```
mark_se(semPaths_plot, object, sep = " ", digits = 2L, ests = NULL)
```

## Arguments

<code>semPaths_plot</code>	A <code>qgraph</code> object generated by <code>semPaths</code> , or a similar <code>qgraph</code> object modified by other <code>semptools</code> functions.
<code>object</code>	The object used by <code>semPaths</code> to generate the plot. Use the same argument name used in <code>semPaths</code> to make the meaning of this argument obvious. Currently only object of class <code>lavaan</code> is supported.
<code>sep</code>	A character string to separate the coefficient and the standard error (in parentheses). Default to " " (one space). Use "\n" to enforce a line break.
<code>digits</code>	Integer indicating number of decimal places for the appended standard errors. Default is 2L.
<code>ests</code>	A <code>data.frame</code> from the <code>parameterEstimates</code> function. Only used when <code>object</code> is not specified.

## Details

Modify a `qgraph::qgraph` object generated by `semPaths` (currently in parentheses) to the labels. Require the original object used in the `semPaths` call.

Currently supports only plots based on `lavaan` output.

This function is a variant of, and can be combined with, the `mark_sig` function.

## Value

If the input is a `qgraph::qgraph` object, the function returns a `qgraph` based on the original one, with standard error estimates appended. If the input is a list of `qgraph` objects, the function returns a list of the same length.

## Examples

```
mod_pa <-
  'x1 ~~ x2
  x3 ~ x1 + x2
  x4 ~ x1 + x3
  '
```



```

fit_pa <- lavaan::sem(mod_pa, pa_example)
lavaan::parameterEstimates(fit_pa)[ , c("lhs", "op", "rhs",
                                         "est", "pvalue", "se")]

m <- matrix(c("x1", NA, NA,
              NA, "x3", "x4",
              "x2", NA, NA), byrow = TRUE, 3, 3)
p_pa <- semPlot::semPaths(fit_pa, whatLabels = "est",
                          style = "ram",
                          nCharNodes = 0, nCharEdges = 0,
                          layout = m)
p_pa2 <- mark_se(p_pa, fit_pa)
plot(p_pa2)

mod_cfa <-
'f1 =~ x01 + x02 + x03
 f2 =~ x04 + x05 + x06 + x07
 f3 =~ x08 + x09 + x10
 f4 =~ x11 + x12 + x13 + x14
'
fit_cfa <- lavaan::sem(mod_cfa, cfa_example)
lavaan::parameterEstimates(fit_cfa)[ , c("lhs", "op", "rhs",
                                         "est", "pvalue", "se")]
p_cfa <- semPlot::semPaths(fit_cfa, whatLabels = "est",
                           style = "ram",
                           nCharNodes = 0, nCharEdges = 0)
# Place standard errors on a new line
p_cfa2 <- mark_se(p_cfa, fit_cfa, sep = "\n")
plot(p_cfa2)

mod_sem <-
'f1 =~ x01 + x02 + x03
 f2 =~ x04 + x05 + x06 + x07
 f3 =~ x08 + x09 + x10
 f4 =~ x11 + x12 + x13 + x14
 f3 ~ f1 + f2
 f4 ~ f1 + f3
'
fit_sem <- lavaan::sem(mod_sem, sem_example)
lavaan::parameterEstimates(fit_sem)[ , c("lhs", "op", "rhs",
                                         "est", "pvalue", "se")]
p_sem <- semPlot::semPaths(fit_sem, whatLabels = "est",
                           style = "ram",
                           nCharNodes = 0, nCharEdges = 0)
# Mark significance, and then add standard errors
p_sem2 <- mark_sig(p_sem, fit_sem)
p_sem3 <- mark_se(p_sem2, fit_sem, sep = "\n")
plot(p_sem3)

```

**Description**

Mark parameter estimates (edge labels) based on p-value.

**Usage**

```
mark_sig(
  semPaths_plot,
  object,
  alphas = c(`*` = 0.05, `**` = 0.01, `***` = 0.001)
)
```

**Arguments**

semPaths_plot	A <a href="#">qgraph::qgraph</a> object generated by semPaths, or a similar qgraph object modified by other <a href="#">semptools</a> functions.
object	The object used by semPaths to generate the plot. Use the same argument name used in semPaths to make the meaning of this argument obvious. Currently only object of class <a href="#">lavaan</a> is supported.
alphas	A named numeric vector. Each element is the cutoff (level of significance), and the name of it is the symbol to be used if p-value is less than this cutoff. The default is c(" = .05, "" = <b>.01</b> , "" = .001).

**Details**

Modify a [qgraph::qgraph](#) object generated by semPaths and add marks (currently asterisk, "\*") to the labels based on their p-values. Require the original object used in the semPaths call.

Currently supports only plots based on lavaan output.

**Value**

A [qgraph::qgraph](#) based on the original one, with marks appended to edge labels based on their p-values.

**Examples**

```
mod_pa <-
  'x1 ~~ x2
  x3 ~ x1 + x2
  x4 ~ x1 + x3
  '
fit_pa <- lavaan::sem(mod_pa, pa_example)
lavaan::parameterEstimates(fit_pa)[, c("lhs", "op", "rhs", "est", "pvalue")]
m <- matrix(c("x1", NA, NA,
              NA, "x3", "x4",
              "x2", NA, NA), byrow = TRUE, 3, 3)
p_pa <- semPlot::semPaths(fit_pa, whatLabels="est",
  style = "ram",
  nCharNodes = 0, nCharEdges = 0,
  layout = m)
```

```

p_pa2 <- mark_sig(p_pa, fit_pa)
plot(p_pa2)

mod_cfa <-
'f1 =~ x01 + x02 + x03
  f2 =~ x04 + x05 + x06 + x07
  f3 =~ x08 + x09 + x10
  f4 =~ x11 + x12 + x13 + x14
  '
fit_cfa <- lavaan::sem(mod_cfa, cfa_example)
lavaan::parameterEstimates(fit_cfa)[, c("lhs", "op", "rhs", "est", "pvalue")]
p_cfa <- semPlot::semPaths(fit_cfa, whatLabels="est",
  style = "ram",
  nCharNodes = 0, nCharEdges = 0)
p_cfa2 <- mark_sig(p_cfa, fit_cfa)
plot(p_cfa2)

mod_sem <-
'f1 =~ x01 + x02 + x03
  f2 =~ x04 + x05 + x06 + x07
  f3 =~ x08 + x09 + x10
  f4 =~ x11 + x12 + x13 + x14
  f3 ~ f1 + f2
  f4 ~ f1 + f3
  '
fit_sem <- lavaan::sem(mod_sem, sem_example)
lavaan::parameterEstimates(fit_sem)[, c("lhs", "op", "rhs", "est", "pvalue")]
p_sem <- semPlot::semPaths(fit_sem, whatLabels="est",
  style = "ram",
  nCharNodes = 0, nCharEdges = 0)
p_sem2 <- mark_sig(p_sem, fit_sem)
plot(p_sem2)

```

---

pa\_example

*Sample dataset pa\_example*


---

### Description

A sample dataset for fitting a path analysis model.

### Usage

```
pa_example
```

### Format

An object of class `data.frame` with 100 rows and 4 columns.

**Details**

Four variables (x1 to x4), 100 cases.

Sample model to fit (in `lavaan::model.syntax` notation)

```
mod <-  
'x1 ~~ x2  
  x3 ~ x1 + x2  
  x4 ~ x1 + x3  
,
```

---

pa\_example\_3covs

*Sample dataset pa\_example\_3covs*

---

**Description**

A sample dataset for fitting a path analysis model, with three control variables.

**Usage**

```
pa_example_3covs
```

**Format**

An object of class `data.frame` with 100 rows and 7 columns.

**Details**

Four variables (x1 to x4), and three control variables (cov1, cov2, cov3), 100 cases.

Sample model to fit (in `lavaan::model.syntax` notation)

```
mod <-  
'  
  x3 ~ x1 + x2 + cov1 + cov2 + cov3  
  x4 ~ x1 + x3 + cov1 + cov2 + cov3  
,
```

---

rotate_resid	<i>Rotate the residuals of selected nodes</i>
--------------	---

---

## Description

Rotate the residuals of selected nodes.

## Usage

```
rotate_resid(semPaths_plot, rotate_resid_list = NULL)
```

## Arguments

`semPaths_plot` A [qgraph::qgraph](#) object generated by [semPlot::semPaths](#), or a similar qgraph object modified by other [semptools](#) functions.

`rotate_resid_list`

A named vector or a list of named list. For a named vector, the name of an element is the node for which its residual is to be rotated, and the value is the degree to rotate. The 12 o'clock position is zero degree. Positive degree denotes clockwise rotation, and negative degree denotes anticlockwise rotation. For example, `c(x3 = 45, x4 = -45)` means rotating the residual of `x3` 45 degrees clockwise, and rotating the residual of `x4` 45 degrees anticlockwise. For a list of named lists, each named list should have two named values: `node` and `rotate`. The position of the residual of node will be placed at `rotate`, in degree. For example, `list(list(node = "x3", rotate = 45), list(node = "x4", rotate = -45))` is equivalent to `c(x3 = 45, x4 = -45)`.

## Details

Modify a [qgraph::qgraph](#) object generated by [semPlot::semPaths](#) and rotate the residuals of selected nodes. Currently only supports "ram" and similar styles of [semPlot::semPaths](#).

## Value

A [qgraph::qgraph](#) object based on the original one, with `loopRotation` attributes of selected nodes modified.

## Examples

```
mod_pa <-
  'x1 ~~ x2
  x3 ~ x1 + x2
  x4 ~ x1 + x3
  '
fit_pa <- lavaan::sem(mod_pa, pa_example)
lavaan::parameterEstimates(fit_pa)[, c("lhs", "op", "rhs", "est", "pvalue")]
m <- matrix(c("x1", NA, NA,
              NA, "x3", "x4",
```

```

      "x2", NA, NA), byrow = TRUE, 3, 3)
p_pa <- semPlot::semPaths(fit_pa, whatLabels="est",
  style = "ram",
  nCharNodes = 0, nCharEdges = 0,
  layout = m)

my_rotate_resid_vector <- c(x3 = 45, x4 = -45)

p_pa2v <- rotate_resid(p_pa, my_rotate_resid_vector)
plot(p_pa2v)

my_rotate_resid_list <- list(list(node = "x3", rotate = 45),
  list(node = "x4", rotate = -45))

p_pa2l <- rotate_resid(p_pa, my_rotate_resid_list)
plot(p_pa2l)

```

---

sem\_2nd\_order\_example *Sample dataset sem\_2nd\_order\_example*

---

### Description

A sample dataset for fitting a latent variable model with two 2nd-order factors.

### Usage

```
sem_2nd_order_example
```

### Format

An object of class `data.frame` with 500 rows and 21 columns.

### Details

Twenty one variables (x01 to x21), 500 cases.

Sample model to fit (in [lavaan::model.syntax](#) notation)

```

mod <-
' f1 =~ x01 + x02 + x03
  f2 =~ x04 + x05 + x06 + x07
  f3 =~ x08 + x09 + x10
  f4 =~ x11 + x12 + x13 + x14
  f5 =~ x15 + x16 + x17 + x18
  f6 =~ x19 + x20 + x21
  f21 =~ 1*f1 + f3 + f4
  f22 =~ 1*f2 + f5 + f6
  f22 ~ f21
'

```

---

sem_example	<i>Sample dataset sem_example</i>
-------------	-----------------------------------

---

**Description**

A sample dataset for fitting a latent variable model.

**Usage**

```
sem_example
```

**Format**

An object of class `data.frame` with 200 rows and 14 columns.

**Details**

Fourteen variables (x01 to x14), 100 cases.

Sample model to fit (in [lavaan::model.syntax](#) notation)

```
mod <-  
'f1 =~ x01 + x02 + x03  
f2 =~ x04 + x05 + x06 + x07  
f3 =~ x08 + x09 + x10  
f4 =~ x11 + x12 + x13 + x14  
f3 ~ f1 + f2  
f4 ~ f1 + f3  
,
```

---

set_cfa_layout	<i>Configure the layout of factors of a CFA graph by semPaths</i>
----------------	---

---

**Description**

Configure the layout of factors and adjust other aspects of a CFA graph by `semPaths`.

**Usage**

```
set_cfa_layout(  
  semPaths_plot,  
  indicator_order = NULL,  
  indicator_factor = NULL,  
  fcov_curve = 0.4,  
  loading_position = 0.5,  
  point_to = "down"  
)
```

**Arguments**

- `semPaths_plot` A `qgraph::qgraph` object generated by `semPaths`, or a similar `qgraph` object modified by other `semptools` functions.
- `indicator_order`  
A string vector of the indicators. The order of the names is the order of the indicators in the graph, when they are drawn on the bottom of the graph. The indicators should be grouped by the factors on which they load on. For example, if `x1`, `x2`, `x4` load on `f2`, and `x3`, `x5`, `x6` load on `f1`, then vector should be either `c("x1", "x2", "x4", "x3", "x5", "x6")` or `c("x3", "x5", "x6", "x1", "x2", "x4")`. Indicators within a group can be ordered in any way.
- `indicator_factor`  
A string vector of the same length of the indicator order, storing the name of the factor for which each of the indicator in `indicator_order` loads on. For example, if `x1`, `x2`, `x4` load on `f2`, and `x3`, `x5`, `x6` load on `f1`, and `indicator_order` is `c("x3", "x5", "x6", "x1", "x2", "x4")`, then `indicator_factor` should be `c("f2", "f2", "f2", "f1", "f1", "f1")`.
- `fcov_curve` A number used to set the curvature of the inter-factor covariances. Default is `.4`.
- `loading_position`  
The positions of all factor loadings. Default is `.5`, on the middle of the arrows. Larger the number, closer the loadings to the indicators. Smaller the number, closer the loadings to the factors.
- `point_to` Can be `"down"`, `"left"`, `"up"`, or `"right"`. Specify the direction that the factors "point" to the indicators. Default is `"down"`.

**Details**

Modify a `qgraph::qgraph` object generated by `semPaths` based on a confirmatory factor analysis model.

**Value**

A `qgraph::qgraph` based on the original one, with various aspects of the model modified.

**Examples**

```
library(lavaan)
library(semPlot)
mod <-
'f1 =~ x01 + x02 + x03
f2 =~ x04 + x05 + x06 + x07
f3 =~ x08 + x09 + x10
f4 =~ x11 + x12 + x13 + x14
'
fit_cfa <- lavaan::sem(mod, cfa_example)
lavaan::parameterEstimates(fit_cfa)[, c("lhs", "op", "rhs", "est", "pvalue")]
p <- semPaths(fit_cfa, whatLabels="est",
  sizeMan = 2.5,
  nCharNodes = 0, nCharEdges = 0,
  edge.width = 0.8, node.width = 0.7,
```



```

        edge.label.cex = 0.6,
        style = "ram",
        mar = c(10,10,10,10))
indicator_order <- c("x04", "x05", "x06", "x07", "x01", "x02", "x03", "x11",
                    "x12", "x13", "x14", "x08", "x09", "x10")
indicator_factor <- c("f2", "f2", "f2", "f2", "f1", "f1", "f1", "f4",
                    "f4", "f4", "f4", "f3", "f3", "f3")
p2 <- set_cfa_layout(p, indicator_order,
                    indicator_factor,
                    fcov_curve = 1.5,
                    loading_position = .8)

plot(p2)
p2 <- set_cfa_layout(p, indicator_order,
                    indicator_factor,
                    fcov_curve = 1.5,
                    loading_position = .8,
                    point_to = "left")

plot(p2)
p2 <- set_cfa_layout(p, indicator_order,
                    indicator_factor,
                    fcov_curve = 1.5,
                    loading_position = .8,
                    point_to = "up")

plot(p2)
p2 <- set_cfa_layout(p, indicator_order,
                    indicator_factor,
                    fcov_curve = 1.5,
                    loading_position = .8,
                    point_to = "right")

plot(p2)

```

---

set\_curve

*Bend or Straighten Selected edges*


---

### Description

Set the curve attributes of selected edges.

### Usage

```
set_curve(semPaths_plot, curve_list = NULL)
```

### Arguments

semPaths\_plot A [qgraph::qgraph](#) object generated by [semPlot::semPaths](#), or a similar qgraph object modified by other [semtools](#) functions.

`curve_list` A named vector or a list of named list. For a named vector, the name of an element should be the path as specified by `lavaan::model.syntax` or as appeared in `lavaan::parameterEstimates()`. For example, to change the curve attribute of the path regressing  $y$  on  $x$ , the name should be `"y ~ x"`. To change the curve attribute of the covariance between  $x_1$  and  $x_2$ , the name should be `"x1 ~~ x2"`. For example, `c("y ~ x1" = -3, "x1 ~~ x2" = 2)` change the curve attributes of the path from  $x_1$  to  $y$  and the covariance between  $x_1$  and  $x_2$  to -3 and 2, respectively. The order of the two nodes *may* matter for covariances. Therefore, if the curve of a covariance is not changed, try switching the order of the two nodes. For a list of named lists, each named list should have three named values: `from`, `to`, and `new_curve`. The curve attribute of the edge from `from` to `to` will be set to `new_curve`.

### Details

Modified a `qgraph::qgraph` object generated by `semPlot::semPaths` and change the curve attributes of selected edges.

### Value

A `qgraph::qgraph` based on the original one, with curve attributes for selected edges changed.

### Examples

```
mod_pa <-
  'x1 ~~ x2
  x3 ~ x1 + x2
  x4 ~ x1 + x3
  '
fit_pa <- lavaan::sem(mod_pa, pa_example)
lavaan::parameterEstimates(fit_pa)[, c("lhs", "op", "rhs", "est", "pvalue")]
m <- matrix(c("x1", NA, NA,
              NA, "x3", "x4",
              "x2", NA, NA), byrow = TRUE, 3, 3)
p_pa <- semPlot::semPaths(fit_pa, whatLabels="est",
  style = "ram",
  nCharNodes = 0, nCharEdges = 0,
  layout = m)

my_curve_vector <- c("x2 ~~ x1" = -1,
  "x4 ~ x1" = 1)

p_pa2v <- set_curve(p_pa, my_curve_vector)
plot(p_pa2v)

my_curve_list <- list(list(from = "x1", to = "x2", new_curve = -1),
  list(from = "x1", to = "x4", new_curve = 1))

p_pa2l <- set_curve(p_pa, my_curve_list)
plot(p_pa2l)
```

---

 set\_edge\_label\_position

*Set the positions of edge labels of selected edges*


---

### Description

Set the positions of edge labels of selected edges.

### Usage

```
set_edge_label_position(semPaths_plot, position_list = NULL)
```

### Arguments

- `semPaths_plot` A [qgraph::qgraph](#) object generated by [semPlot::semPaths](#), or a similar [qgraph](#) object modified by other [semptools](#) functions.
- `position_list` A named vector or a list of named lists. For a named vector, the name of an element should be the path as specified by [lavaan::model.syntax](#) or as appeared in [lavaan::parameterEstimates\(\)](#). For example, to change position of the edge label of the path regressing  $y$  on  $x$ , the name should be " $y \sim x$ ". The value is the position. The mid-point of the edge is 0.5. The closer the value to 1, the closer the label to the left-hand-side node ( $y$  in this example). The closer the value to 0, the closer the label to the right-hand-side node ( $x$  in this example). For example, `c("y ~ x1" = .2, "y ~ x2" = .7)` moves the path coefficient from  $x1$  to  $y$  closer to  $x$ , and the path coefficient from  $x2$  to  $y$  closer to  $y$ . For a list of named lists, each named list should have three named values: `from`, `to`, and `new_position`. The edge label position of the edge from `from` to `to` will be set to `new_position`. For example, `list(list(from = "x1", to = "y", new_position = .2), list(from = "x2", to = "y", new_position = .7))` is equivalent to the named vector above.

### Details

Modify a [qgraph::qgraph](#) object generated by [semPlot::semPaths](#) and change the edge label positions of selected edges.

### Value

A [qgraph::qgraph](#) based on the original one, with edge label positions for selected edges changed.

### Examples

```
mod_pa <-
  'x1 ~~ x2
  x3 ~ x1 + x2
  x4 ~ x1 + x3
  '
fit_pa <- lavaan::sem(mod_pa, pa_example)
```

```

lavaan::parameterEstimates(fit_pa)[, c("lhs", "op", "rhs", "est", "pvalue")]
m <- matrix(c("x1", NA, NA,
             NA, "x3", "x4",
             "x2", NA, NA), byrow = TRUE, 3, 3)
p_pa <- semPlot::semPaths(fit_pa, whatLabels="est",
                        style = "ram",
                        nCharNodes = 0, nCharEdges = 0,
                        layout = m)

my_position_vector <- c("x3 ~ x2" = .25,
                      "x4 ~ x1" = .75)
p_pa2v <- set_edge_label_position(p_pa, my_position_vector)
plot(p_pa2v)

my_position_list <- list(list(from = "x2", to = "x3", new_position = .25),
                       list(from = "x1", to = "x4", new_position = .75))
p_pa2l <- set_edge_label_position(p_pa, my_position_list)
plot(p_pa2l)

```

---

set\_sem\_layout

*Configure the layout of factors of an SEM graph by [semPlot::semPaths](#)*


---

## Description

Configure the layout of factors and adjust other aspects of an SEM graph by [semPlot::semPaths](#).

## Usage

```

set_sem_layout(
  semPaths_plot,
  indicator_order = NULL,
  indicator_factor = NULL,
  factor_layout = NULL,
  factor_point_to = NULL,
  indicator_push = NULL,
  indicator_spread = NULL,
  loading_position = 0.5
)

```

## Arguments

- `semPaths_plot` A [qgraph::qgraph](#) object generated by `semPaths`, or a similar `qgraph` object modified by other [semptools](#) functions.
- `indicator_order` A string vector of the indicators. The order of the names is the order of the indicators in the graph, when they are drawn on the bottom of the graph. The indicators should be grouped by the factors on which they load on. For example,

if  $x_1, x_2, x_4$  load on  $f_2$ , and  $x_3, x_5, x_6$  load on  $f_1$ , then vector should be either  $c("x1", "x2", "x4", "x3", "x5", "x6")$  or  $c("x3", "x5", "x6", "x1", "x2", "x4")$ . Indicators within a group can be ordered in any way.

- indicator\_factor** A string vector of the same length of the indicator order, storing the name of the factor for which each of the indicator in `indicator_factor` loads on. For example, if  $x_1, x_2, x_4$  load on  $f_2$ , and  $x_3, x_5, x_6$  load on  $f_1$ , and `indicator_order` is  $c("x3", "x5", "x6", "x1", "x2", "x4")$ , then `indicator_factor` should be  $c("f2", "f2", "f2", "f1", "f1", "f1")$ .
- factor\_layout** A matrix of arbitrary size. This matrix will serve as a grid for users to specify where each latent factor should be placed approximately on the graph. Each cell should contain NA or the name of a latent factor. The locations of all latent factors must be explicitly specified by this matrix.
- factor\_point\_to** A matrix of the same size as `factor_layout`. This matrix specifies where the indicators of each factor are positioned. Each cell should contain NA or one of these strings: "down", "left", "up", or "right". This is the direction that the corresponding latent factor (specified in `factor_layout`) points to its indicators.
- indicator\_push** (Optional) This argument is used to adjust the positions of the indicators of selected latent factors. It can be named vector or a list of named lists. For a named vector, The name is the factor of which the indicators will be "pushed", and the value is how "hard" the push is: the multiplier to the distance from the factor to the indicators. If this value is 1, then there is no change. If this value is greater than 1, then the indicators are pushed away from the latent factor. If this value is less than 1, then the indicators are pulled toward the latent factor. For example, to push the indicators of  $f_3$  away from  $f_3$ , and pull the indicators of  $f_4$  toward  $f_4$ , the argument can be set to  $c(f_3 = 1.5, f_4 = .5)$ . For a list of named list, each named list has two named elements: `node`, the name of a latent factor, and `push`, how the positions of its indicators will be adjusted. For example, to have the same effect as the vector above, the list is  $list(list(node = "f3", push = 1.5), list(node = "f4", push = .5))$ .
- indicator\_spread** (Optional) This argument is used to adjust the distance between indicators of selected latent factors. It can be a named vector or a list of named lists. For a named vector, the name is the factor of which the indicators will be spread out. The value is the multiplier to the distance between neighboring indicators. If this value is equal to 1, there is no change. Larger than one, the indicators will be "spread" away from each other. Less than one, the indicators will be placed closer to each others. For example, to spread the indicators of  $f_1$  and  $f_4$  farther away from each other, this argument can be set to  $c(f_1 = 2, f_4 = 1.5)$ , with the indicators of  $f_1$  being spread out more than those of  $f_4$ . For a list of named list, each named list has two named elements: `node`, the name of a latent factor, and `spread`, how the distance between indicators will be adjusted. For example, to have the same effect as the vector above, the argument can be set to  $list(list(node = "f1", spread = 2), list(node = "f4", spread = 1.5))$ .
- loading\_position** (Optional) Default is .5. This is used adjust the position of the loadings. If this is one single number, it will be used to set the positions of all loadings. If it is .5,

the loadings are placed on the center of the arrows. Larger the number, closer the loadings to the indicators. Smaller the number, closer to the latent factors. This argument also accepts a named vector or a list of named lists, allowing users to specify the positions of loadings for each factor separately. For a named vector, in each element, the name is the factor whose loadings will be moved. The value is the positions of its loadings. The default is `.50`. We only need to specify the positions for factors to be changed from `.50` to other values. For example, move the loadings of `f2` closer to the indicators and those of `f4` close to the `f4`, this argument can be set to `c(f2 = .7, f4 = .3)`. For a list of named list, each named list should have two named elements: `node`, the name of the latent factor, and `position`, the positions of all loadings of this factors. To have the same effect as the vector above, this list can be used: `list(list(node = "f2", position = .7), list(node = "f4", position = .3))`.

### Details

Modify a `qgraph::qgraph` object generated by `semPaths` based on an SEM model with latent factors. Since version 0.2.9.5, this function natively supports observed exogenous variable. If a variable is listed in both `indicator_order` and `indicator_factor`, as if it is both a factor and an indicator, this function will assume that it is an observed exogenous variable. It will be positioned as a factor according to `factor_layout`, but no indicators will be drawn.

For versions older than 0.2.9.5, an observed exogenous variable needs to be specified as an one-indicator factor in the model specification for this function to work.

### Value

A `qgraph::qgraph` based on the original one, with various aspects of the model modified.

### Examples

```
library(lavaan)
library(semPlot)
mod <-
'f1 =~ x01 + x02 + x03
 f2 =~ x04 + x05 + x06 + x07
 f3 =~ x08 + x09 + x10
 f4 =~ x11 + x12 + x13 + x14
 f3 ~ f1 + f2
 f4 ~ f1 + f3
,
fit_sem <- lavaan::sem(mod, sem_example)
lavaan::parameterEstimates(fit_sem)[, c("lhs", "op", "rhs", "est", "pvalue")]
p <- semPaths(fit_sem, whatLabels="est",
  sizeMan = 5,
  nCharNodes = 0, nCharEdges = 0,
  edge.width = 0.8, node.width = 0.7,
  edge.label.cex = 0.6,
  style = "ram",
  mar = c(10,10,10,10))
indicator_order <- c("x04", "x05", "x06", "x07", "x01", "x02", "x03",
  "x11", "x12", "x13", "x14", "x08", "x09", "x10")
```

```

indicator_factor <- c( "f2", "f2", "f2", "f2", "f1", "f1", "f1",
                      "f4", "f4", "f4", "f4", "f3", "f3", "f3")
factor_layout <- matrix(c("f1", NA, NA,
                          NA, "f3", "f4",
                          "f2", NA, NA), byrow = TRUE, 3, 3)
factor_point_to <- matrix(c("left", NA, NA,
                            NA, "down", "down",
                            "left", NA, NA), byrow = TRUE, 3, 3)
indicator_push <- c(f3 = 2, f4 = 1.5)
indicator_spread <- c(f1 = 2, f2 = 2)
loading_position <- c(f1 = .5, f2 = .8, f3 = .8)
# Pipe operator can be used if desired
p2 <- set_sem_layout(p,
                    indicator_order = indicator_order,
                    indicator_factor = indicator_factor,
                    factor_layout = factor_layout,
                    factor_point_to = factor_point_to,
                    indicator_push = indicator_push,
                    indicator_spread = indicator_spread,
                    loading_position = loading_position)
p2 <- set_curve(p2, c("f2 ~ f1" = -1,
                    "f4 ~ f1" = 1.5))
p2 <- mark_sig(p2, fit_sem)
p2 <- mark_se(p2, fit_sem, sep = "\n")
plot(p2)

#Lists of named list which are equivalent to the vectors above:
#indicator_push <- list(list(node = "f3", push = 2),
#                       list(node = "f4", push = 1.5))
#indicator_spread <- list(list(node = "f1", spread = 2),
#                          list(node = "f2", spread = 2))
#loading_position <- list(list(node = "f1", position = .5),
#                          list(node = "f2", position = .8),
#                          list(node = "f3", position = .8))

```

---

to\_list\_of\_lists

*Convert a named vector to a list of lists*


---

## Description

Convert a named vector to a list of lists, to be used by various functions in [semptools](#).

## Usage

```
to_list_of_lists(input, name1 = NULL, name2 = NULL, name3 = NULL)
```

**Arguments**

input	A named vector
name1	The name for the first element in the list-in-list. Default is NULL.
name2	The name for the second element in the list-in-list. Default is NULL.
name3	The name for the third element in the list-in-list. Default is NULL. If this argument is not NULL, the names of the vector elements will be split using lavaan syntax (by calling <code>lavaan::lavParseModelString()</code> ), and the right-hand side (rhs) and left-hand side (lhs) of each element will be assigned to name1 and name2, respectively.

**Details**

This function is not to be used by users, but to be used internally by other functions of [semptools](#).

**Value**

A list of lists.

**Examples**

```
x <- c("x1 ~~ x2" = -1, "x4 ~ x1" = 1)
to_list_of_lists(x, name1 = "from", name2 = "to", name3 = "new_curve")
#list(list(from = "x1", to = "x2", new_curve = -1),
#      list(from = "x1", to = "x4", new_curve = 1))

y <- c(x1 = 0, x2 = 180, x3 = 140, x4 = 140)
to_list_of_lists(y, name1 = "node", name2 = "rotate")
#list(list(node = "x1", rotate = 0),
#      list(node = "x2", rotate = 180),
#      list(node = "x3", rotate = 140),
#      list(node = "x4", rotate = 140))
```



# Index

## \* datasets

- cfa\_example, 2
- pa\_example, 11
- pa\_example\_3covs, 12
- sem\_2nd\_order\_example, 14
- sem\_example, 15

cfa\_example, 2

change\_node\_label, 3

drop\_nodes (keep\_drop\_nodes), 5

drop\_nodes(), 6

is\_dv\_residvar, 4

keep\_drop\_nodes, 5

keep\_nodes (keep\_drop\_nodes), 5

keep\_nodes(), 6

lavaan, 8, 10

lavaan::lavaan, 4

lavaan::lavParseModelString(), 24

lavaan::model.syntax, 2, 12, 14, 15, 18, 19

lavaan::parameterEstimates(), 18, 19

layout\_matrix, 7

mark\_se, 8

mark\_sig, 8, 9

pa\_example, 11

pa\_example\_3covs, 12

parameterEstimates, 8

qgraph::qgraph, 3, 4, 8, 10, 13, 16–20, 22

rotate\_resid, 13

sem\_2nd\_order\_example, 14

sem\_example, 15

semPaths, 8

semPlot::semPaths, 3, 4, 13, 17–20

semPlot::semPaths(), 3, 6, 7

semPlot::semPlotModel, 6

semPlot::semPlotModel(), 6

semptools, 3, 8, 10, 13, 16, 17, 19, 20, 23, 24

set\_cfa\_layout, 15

set\_curve, 17

set\_edge\_label\_position, 19

set\_sem\_layout, 20

to\_list\_of\_lists, 23