Creating Path Model Diagrams

Appendix to *Latent Variable Modeling using R: A Step-by-Step Guide*

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There are variety of programs available to create path model diagrams.

1 \LaTeX

The path model diagrams used in this text were created in \LaTeX using the PGF/TikZ (Tantau, 2007), which is a very powerful graphics package. As an example, to create the diagram in Figure 2, I used the following syntax.

```latex
\begin{tikzpicture}
% This needs to be added to the LaTeX preamble
\usepackage{tikz}
\usetikzlibrary{positioning,shapes,arrows}
% This starts the function and defines the path model shapes
\begin{tikzpicture}[auto,>=latex,align=center,
latent/.style={circle,draw, thick,inner sep=0pt,minimum size=10mm},
manifest/.style={rectangle,draw, thick,inner sep=2pt,minimum size=10mm},
mean/.style={regular polygon,regular polygon sides=3,draw,thick,inner sep=0pt,minimum size=10mm},
paths/.style={->, very thick, >=stealth'},
variance/.style={<->, thick, >=stealth', bend left=270, looseness=2},
]
% Draw, place, and label variables
\node [latent] (LV1) at (0,0) {g};
\node [manifest] (WR) [below =of LV1] {Word\Reasoning};
\node [manifest] (SI) [left =of WR] {Similarities};
\node [manifest] (IN) [left =of SI] {Information};
\node [manifest] (MR) [right =of WR] {Matrix\Reasoning};
\node [manifest] (PS) [right =of MR] {Picture\Similarities};
\node [latent] (EIN) [below =of IN] {Error};
\node [latent] (ESI) [below =of SI] {Error};
\node [latent] (EWR) [below =of WR] {Error};
\node [latent] (EMR) [below =of MR] {Error};
\node [latent] (EPS) [below =of PS] {Error};
% Draw paths from LV to MV, with labels.
% The pos argument places the label up/down the path.
\draw [paths,above] (LV1) to node {a} (IN); 
\draw [paths,above] (LV1) to node [pos=.75] {b} (SI); 
\draw [paths] (LV1) to node {c} (WR); 
\draw [paths] (LV1) to node [pos=.75] {d} (MR); 
\draw [paths] (LV1) to node {e} (PS); 
% Draw paths from residuuals to MVs
\foreach \e in {IN, SI, WR, MR, PS}
\draw [paths] (E\e) to node {1} (\e); 
% Draw residual error paths and label them
\foreach \e/xlab in {EIN/f, ESI/g,EWR/h, EMR/i, EPS/j}
\draw [variance] (\e.south west) to node [swap] {xlab} (\e.south east);
\end{tikzpicture}
```

**Figure 1** PGF/TikZ syntax for the path diagram in Figure 2.

2 Graphviz

If you do not want to learn the \LaTeX language, another option is the Graphviz program (http://www.graphviz.org). An example Graphviz path diagram is shown in Figure 4.

```graphviz
digraph Simple_Factor {
// This makes all lines straight
```
Figure 2 Latent variable model path diagram created with \LaTeX.

```latex
splines=false;
node [shape="box"]; // Paths from g
g-> I[label="a"]
g-> S[label="b"]
g-> W[label="c"]
g-> M[label="d"]
g-> P[label="e"]

// Paths from MVs to residuals
I-> ui [dir=back, label="1"];
S-> us [dir=back, label="1"]
W-> uw [dir=back, label="1"]
M-> um [dir=back, label="1"]
P-> up [dir=back, label="1"]

// Define the shape of the latent variables
g[shape=circle]
ui[shape=circle, label="Error", fixedsize=TRUE, width=.6in]
us[shape=circle, label="Error", fixedsize=TRUE, width=.6in]
wuw[shape=circle, label="Error", fixedsize=TRUE, width=.6in]
um[shape=circle, label="Error", fixedsize=TRUE, width=.6in]
up[shape=circle, label="Error", fixedsize=TRUE, width=.6in]

// Label the residuals' variance
ui-> ui [dir=both, label="f"]
us-> us [dir=both, label="g"]
wuw-> uw [dir=both, label="h"]
um-> um [dir=both, label="i"]
up-> up [dir=both, label="j"]

// Label the MVs
I[label="Information"]
S[label="Similarities"]
W[label="Word \n Reasoning"]
M[label="Matrix \n Reasoning"]
P[label="Picture \n Similarities"]
```

Figure 3 Graphviz syntax for the path diagram in Figure 4.
Figure 4 Latent variable model path diagram created with *Graphviz*.

### 3 R Packages

The *psych* package can create rough path diagrams via the `lavaan.diagram()` function. Example syntax for the function is shown below, and the resulting output is shown in Figure 5.

```r
library(psych)
lavaan.diagram(WiscIV.fit)
```

Figure 5 Example of a latent variable model created with `lavaan.diagram()` function in the *psych* package
Figure 6 Example of a latent variable model created with semPlot.

The semPlot package can also create path diagrams using the semPaths() function. Example syntax is given below and the resulting diagram is given in Figure 6.

```r
# path diagram via the semPlot package
library(semPlot)
semPaths(object=WiscIV.fit, what="std", edge.label.cex=1, curvePivot = TRUE,
fixedStyle=c("black",1), freeStyle=c("black",1), edge.color="black")
```

4 Graphical User Interfaces

There are many commercial programs with a graphical user interface (GUI) to create path models, such as PowerPoint, Keynote, OpenOffice’s Draw, and OmniGraffle (http://www.omnigroup.com/products/omnigraffle/). Ωnyx (http://onyx.brandmaier.de) is a freeware program that takes a drawn path model as passes it to OpenMx package in R for analysis.

References