Amos™ 6.0 – Specifications

Test Relationships in Attitudinal and Behavioral Models

Amos is powerful structural equation modeling (SEM) software that enables you to support your research and theories by extending standard multivariate analysis methods, including regression, factor analysis, correlation, and analysis of variance. In Amos, you specify, estimate, assess, and present your model in an intuitive path diagram to show hypothesized relationships among variables.

Confirm complex relationships

You can build attitudinal and behavioral models in Amos that more realistically reflect complex relationships because any numeric variable, whether observed (such as data from a survey) or latent (such as satisfaction and loyalty), can be used to predict any other numeric variable. These models can help you confirm complex relationships. For example, confirm that motivation is more important than intelligence in predicting job performance.
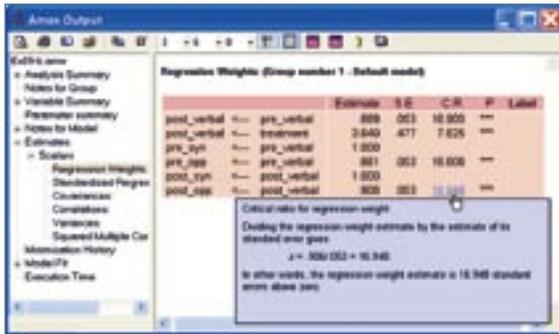
Amos enables you to simultaneously analyze data from several populations, such as multiple ethnic groups. Increase the reliability of variables in your analysis by including multiple indicators. Impute missing values and latent scores, such as factor scores, with multiple imputation. You can also use Amos for longitudinal studies, multiple-group analysis, and reliability analysis.

Go from onscreen model to published results quickly

Amos' interactive, visual approach to SEM makes it easy for you to learn and use. Build models using configurable toolbars and drag-and-drop functionality. Within Amos' interface you can create path diagrams of your analysis using drawing tools, rather than writing equations or typing commands. Or, you can extend the capabilities of Amos with popular Microsoft® programming languages such as Visual Basic® and C#.

Once you complete a model, you can assess fit with a mouse-click. Then, when your model is complete, you can print presentation-quality output. Amos includes 31 completed examples as an introduction to structural equation modeling. It also has an extensive online help system, including "use-it-in-a-sentence" help for interpreting or summarizing results.

Regression with unobserved variables
Job performance of farm managers
Warren, Whaite and Fuller (1974)

Find models that best fit your data

Use Amos' exploratory technique, SEM specification search, to choose a model from a large number of candidates. Take advantage of previous research by specifying constraints on parameter values in your model, or use Bayesian estimation to specify an informative prior distribution for the parameters. Use confirmatory factor analysis in Amos to specify and test a factor pattern, instead of relying on traditional exploratory factor analysis.

You can also fit multiple models in a single analysis. Amos examines every pair of models where one model can be obtained by placing parameter restrictions on the other. Amos even suggests how the model may be improved—for example, by adding an arrow to connect two variables. Graphs and statistics help you find an optimum trade-off between model simplicity and goodness of fit.

Discover unexpected relationships using path diagrams

After you fit a model, the Amos path diagram shows the strength of the relationship between variables. For example, when working with data from a product survey on condiments, you might initially assume that the variable, "satisfaction of taste," is the best brand loyalty indicator. Looking at the path diagram in Amos, however, you might discover that the best brand loyalty indicator is "package size purchased."

Apply Amos to explore the "hows and whys" in your data

Researchers and graduate students who have observational, or non-experimental, data apply Amos in a variety of fields to convince a committee or boss, secure funding, or get published. Examples include:

- **Psychology**—Develop models to understand how drug, clinical, and art therapies affect mood
- **Medical and healthcare research**—Confirm which of three variables—confidence, savings, or research—best predicts a doctor's support for prescribing generic drugs
- **Social sciences**—Study how socioeconomic status, organizational membership, and other determinants influence differences in voting behavior and political engagement
- **Educational research**—Evaluate training program outcomes to determine impact on classroom effectiveness
- **Market research**—Model how customer behavior impacts new product sales
- **Institutional research**—Study how work-related issues affect job satisfaction

Use with SPSS products you may already have

While you can use Amos on its own, you can also use it to extend the analyses you might already be doing using SPSS for Windows®. It especially complements your analyses if you use SPSS Advanced Models™ or SPSS Regression Models™, because SEM extends algorithms available in these programs.

Features

Graphical user interface

- Display, through a path-diagram browser, a description and thumbnail image of all path diagrams in your folders
- Simply point-and-click to select program options
- Display a diagram for a different group or model with just one click
- View the contents of data files
- Drag variable names from the dataset to the path diagram
- ▣ Create variables in path diagrams with a single mouse click

Modeling capabilities

- Create structural equation models (including such special cases as path analysis and longitudinal data models) with observed and latent variables
- Specify candidate models using one of two methods:
  - Specify each individual candidate model as a set of equality constraints on model parameters
  - Use SEM in an exploratory way. Amos tries out many models and suggests promising ones, while using Akaike information criterion (AIC) and Bayes information criterion (BIC) statistics to compare models.
- Fit confirmatory factor analysis models, variance components models, errors-in-variables models, and general latent variable models
- Analyze mean structures and multiple group datasets
  - Quickly specify and test multiple group data through automated specification
- Analyze data from several populations at once
- Save time by combining factor and regression models into a single model, and then fit them simultaneously
- Analyze multiple models simultaneously: Amos determines which models are nested and automatically calculates test statistics

Bayesian estimation

- ▣ Markov chain Monte Carlo (MCMC) simulation
- ▣ Specify an informative prior distribution: Normal, uniform, or custom
- ▣ Plot the marginal posterior distribution of any parameter
- ▣ Estimate any function of model parameters
- ▣ Avoid inadmissible solutions and unstable linear systems
- ▣ Obtain optimal asymmetric credible intervals for indirect effects

Computationally intensive modeling

- Evaluate parameter estimates with normal or non-normal data using powerful bootstrapping options. The bootstrapping and Monte Carlo capabilities in Amos make it easy for you to obtain bias and standard error estimates for any parameter, including standardized coefficients and effect estimates.
- Test multivariate normality and perform outlier analysis

Model creation

- Use the path diagram as a model specification
- Modify the model by changing the path diagram with drawing tools
- Display parameter estimates and fit measures graphically on the path diagram
- Display degrees of freedom at any time while drawing on the path diagram

Analytical capabilities and statistical functions

- Use full information maximum likelihood estimation in missing data situations for more efficient and less biased estimates
- Enter parameter values so that you may observe the effect on implied moments and the value of discrepancy function, using the modeling laboratory
- Obtain an approximate confidence interval for any model parameter under any empirical distribution, including standardized coefficients, using fast bootstrap simulation
  - Assess model fit with Bollen and Stine's bootstrap approach
  - Calculate percentile intervals and bias-corrected percentile intervals

- Perform randomized permutation tests to show whether equivalent or better-fitting models can be found
- Specify equality constraints in the path diagram by using the same label for two or more parameters, including means, intercepts, regression weights, and/or covariances, in the same group or across different groups
- Estimate means for exogenous variables
- Estimate intercepts in regression equations
- Recalculate the degrees of freedom after adding new elements or changing model constraints
- Perform parametric bootstraps to find an approximate confidence interval for any model parameter under normal distribution theory, including standardized coefficients with Monte Carlo simulation
- Use a variety of estimation methods, including maximum likelihood, unweighted least squares, generalized least squares, Browne's asymptotically distribution-free criterion, and scale-free least squares
- Evaluate models using more than two dozen fit statistics, including Chi-square; AIC; Bayes and Bozdogan information criteria; Browne-Cudeck (BCC); ECVI, RMSEA, and PCLOSE criteria; root mean square residual; Hoelter's critical n; and Bentler-Bonett and Tucker-Lewis indices
- Obtain bias and standard error estimates for any parameter and derived statistics with bootstrapping or Monte Carlo options
- Optionally, estimate standard errors using the observed information matrix
- View p values along with critical ratios for individual parameters

Output

- Use additional navigation aids, display options, and table-formatting options with enhanced text output
  - Quickly navigate to and display portions of output in the navigation panel
  - Link section and table headings to context-sensitive help
  - Link numbers, such as p values displayed in the navigation panel, to "use-it-in-a-sentence" help, and receive a plain-English description of what the numbers represent

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Features subject to change based on final product release.   ☐ *Symbol indicates a new feature.*

- View XHTML (Web-based) output of your text files in your browser
  - Preserve table formatting when you use the clipboard or drag-and-drop editing to copy tables to other applications
  - Use XHTML-formatted files as an archival format
  - Parse Amos output using an XML parser; when writing programs to post-process Amos output, use an XPATH expression to extract any desired portion of the output
- Print preview

Data imputation
- Impute missing values and latent variable scores
- Choose from three different methods: Regression, stochastic regression, and Bayesian
- Single imputation:
  - Regression imputation uses linear regression to replace missing values
- Single or multiple imputation:
  - Stochastic regression imputation uses maximum likelihood (ML)-based parameter estimates of observed data; assumes parameters are equal to their ML estimates
  - Bayesian estimation is similar to stochastic regression imputation; however, it assumes that parameter values are estimated, not known

Drawing and other tools
- Create presentation-quality path diagrams
  - Easily show or hide all variable names or labels in a path diagram
- Print or paste path diagrams into other applications
- Use toolbox buttons, including shape, copy, erase, fit-to-page, and align, to draw your model
- Customize the toolbar
  - Associate a toolbar button, menu item, or hot key with any Amos macro, including those you write yourself
  - Add an image to a toolbar button
  - Create a shortcut key for macro execution
- Fit your model by selecting buttons on the toolbar
- Work with variable names you assign, instead of Greek letters
- Add titles and annotations to your diagram
- Work with the toolbar, menus, and hot keys for frequently used tasks
- Use pop-up menus that show useful actions for each element in your diagram
- Rearrange measurement models by using the reflect and rotate buttons
- Use macros to extend program capabilities

Programmability
- Specify models non-graphically by writing programs with Visual Basic or C#
- Extend the capabilities of Amos:
  - In Bayesian analysis, find the posterior distribution of any function of the parameters
  - Define your own fit measures

Documentation and help
- Extensive online help with cross-references to explanations of the output
- Includes *User's Guide* PDF file with 31 completed examples

Data and file management
- File types supported include: dBASE® (.dbf), Microsoft® Excel® (.xls), FoxPro® (.dbf), Lotus® (.wk1, .wk3, .wk4), Microsoft Access® (.mdb), SPSS (.sav), and text (.txt, .csv)

System requirements
- Operating system: Microsoft Windows® XP, 2000, or Me
- Memory: 256MB RAM minimum
- Minimum free drive space: 125MB
- Web browser: Internet Explorer 6

SPSS