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SmartPLS Manual



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http://ibl-unihh.de

Weppage of the SmartPLS project :

http://www.smartpls.de

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1. Introduction

SmartPLS is a software application for the design of structural equation models (SEM) on a graphical user interface (GUI). These models can be measured with the method of partial least squares (PLS)-analysis. Hence, it is possible to import data of manifest (indicator) variables in the model. This software was created in a project at the Institute of Operations Management and Organizations (School of Business), University of Hamburg (Germany).

2. Installation

SmartPLS employs the Java WebStart technology. Thus, it is applicable on all computer operating systems and the latest version is always provided.

2.1. System Requirements

In order to use SmartPLS, the *Java Runtime Environment (JRE)* version 1.4. (or later) has to be installed on the computer system. The JRE is available for almost every computer operating system and can directly be downloaded for free from the Webpage of Sun Microsystems, Inc.:

http://java.sun.com/j2se/1.4.2/download.html

2.2. Start SmartPLS

Step 1: Open the Webpage http://www.smartpls.de.

Step 2: Select the English version of the Webpage.

Step 3: Click on SmartPLS.

Step 4: Click on SmartPLS WebStart.

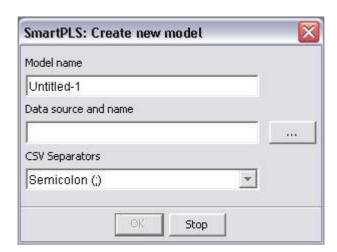
3. Main Window

After opening SmartPLS, the main window appears. It is possible to either create a new model or to open an existing model.

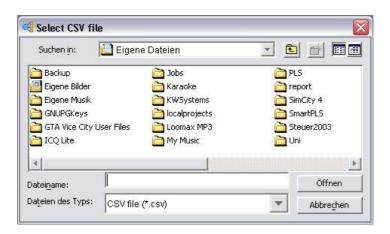


3.1. Create New Model

When selecting the option **Create new model**, the following dialog opens. A model name, the data source and name for the model indicators as well as a separator for the CSV (comma separated value) file are required to start a new project.

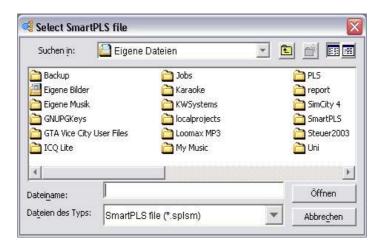


A CSV file as source for the manifest variables in the model must be chosen. Such files can be generated with several software applications, e.g. Excel or SPSS.



3.2. Open Model

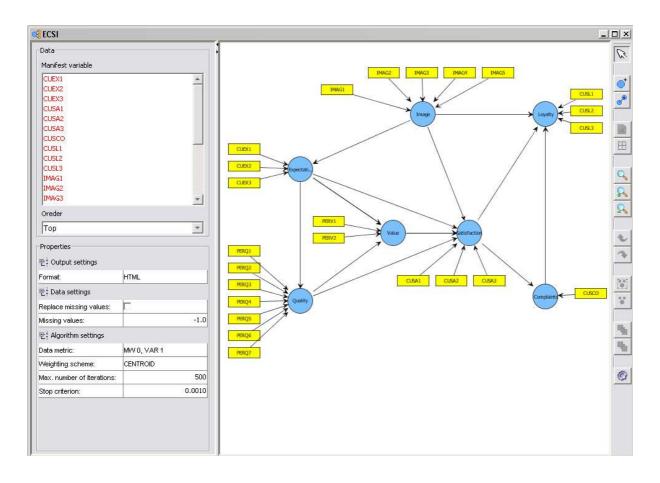
SmartPLS models are saved with the extension *.splsm* and can be opened with the function **Select SmartPLS file**.



Note: A SmartPLS model file (.*splsm*) consists of both the model structure as well as the data for the manifest variables. Thus, all required information are saved in one file and models can be easily transferred.

4. Model Editor

After selecting either the function create new model or open model, the SmartPLS model editor can be used to create, change and calculate models. It is also possible to work with more than one model in the same session. Every model appears in its own window. The model editor is divided into three different areas: manifest variables, properties and drawing board.



4.1. Options

4.1.1. Output Options

Settings for the report file format can be changed in the **format** field. The current version only supports HTML (hypertext markup language).

4.1.2. Data Options

The option **replace missing values** and **missing values** defines, if and how missing values in the indicator data files shall be replaced before the model calculation starts.

4.1.3. Algorithm Options

Different settings for the PLS algorithm can be selected in this field: data metric, weighting scheme, maximum number of iterations and stop criterion.

4.2. Working Area

New models are designed or existing models are changed in this area. The required modeling functions are provided in the tool bar.

4.2.1. Drawing Area

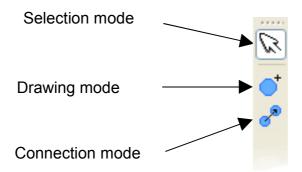
In the drawing area, new models can be created or existing models can be changed with the functionalities that are provided in the tool bar.

4.2.2. Tool Bar

The tool bar allows to quickly access all functionalities that are necessary to create and change models.

a) Modelling Modes

SmartPLS has three different modelling modes that can be used for the design and change of models: selection mode, drawing mode and connection mode.



Selection mode 🖟



Objects on the drawing board can be selected and moved in the selection modus. Holding the [SHIFT] key pressed allows for multiple selection of objects. An existing object on the drawing board can be edited in this mode by doubleclicking with the left mouse button.



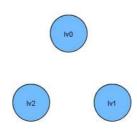
Note: Keep the [SHIFT]-button pressed to only horizontally or vertically move objects with the mouse pointer.

Note: Click with the right mouse button on an empty area on the drawing board in order to automatically change the selection mode.

• Drawing mode



Latent model variables can be added in the drawing mode. Click with left mouse button on the drawing area to create a new latent variable with a standard label (lv0, lv1, lv2...). The name of the latent variables can be changed (see selection mode).



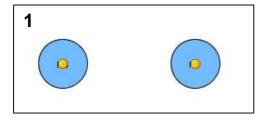
· Connection mode

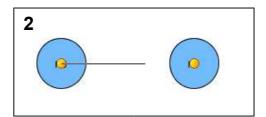


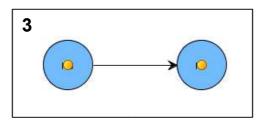
The connection between the latent variables can be established in the connection mode. If the connection mode is selected, connection points (ports) appear in the middle of all latent variables.



In order to connect two latent variables, the mouse pointer has to be moved on a port (the cursor changes). Then, press the left mouse button and keep it pressed while moving the mouse pointer to the target variable (the connection line is drawn simultaneously). When the port of the target variable is reached, stop pressing the left mouse button in order to create the connection.

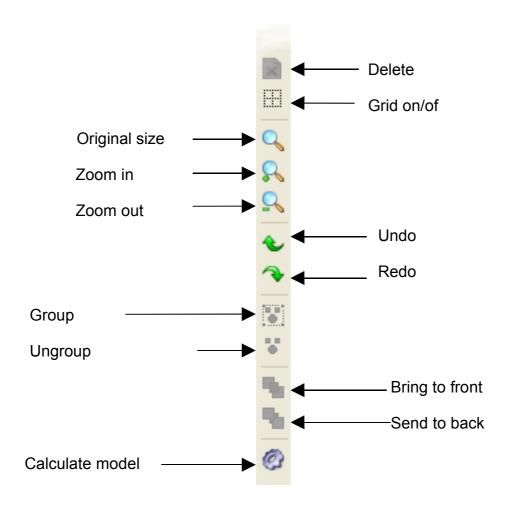






b) Modelling Functions

Several useful functions are provided in the tool bar for the creation and change of models.



• Delete 🔀

Selected elements on the drawing board can be deleted with this function (🗷).

· Grid on/off

This function () allows to show and hide a grid on the drawing area.

· Zoom Functions $\mathbb{Q} \mathbb{R} \mathbb{R}$

The functions **zoom in** (\mathbb{N}) and **zoom out** (\mathbb{N}) change the displayed size of the model. The function **original size** (\mathbb{N}) resets the changes to the original size of 100%.

Note: The displayed size of the model can also be changed with the wheel of a scroll/wheel mouse.

Undo/Redo

The last changes can be taken back stepwise with the function **undo** ($^{\diamond}$). Use the function **redo** ($^{\diamond}$) in order to redo the undo actions.

• Group/Ungroup

The function **group** (can be used to combine several selected elements on the drawing area, while the function **ungroup** (dissolves these combinations.

• Bring to front/Move to back 🔁 👈

The functions **bring to front** () and **move to back** () can be used to change the displayed order of overlapping objects on the drawing board.

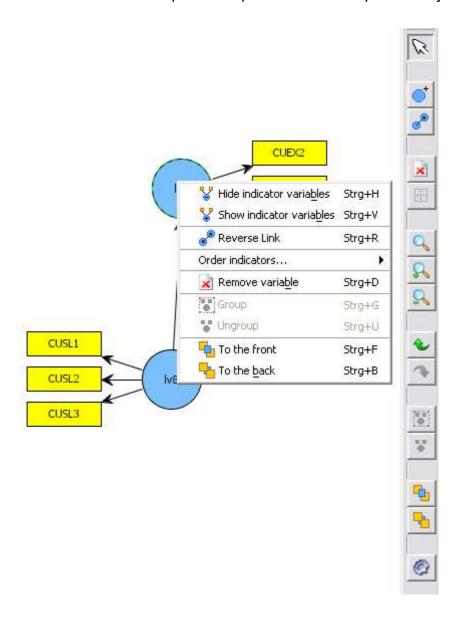
· Calculate model



The function **calculate** (starts the model measurement.

4.2.3. Context Menu

Apart from the tool bar, the context menu offers several (additional) functions for editing models. The context menu can be opened with the right mouse button as soon as the mouse pointer is placed on the respective object.

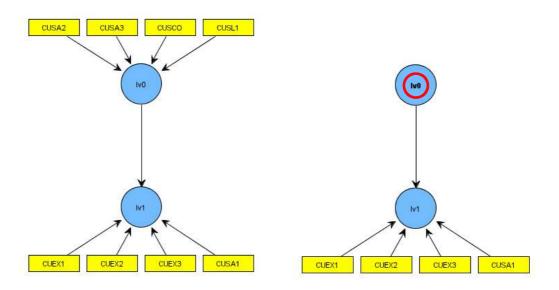


Show/hide Indicators



Larger models have a relatively complex structure. The function hide indicators () allows to hide all indicator variables of a selected latent variable. Thus, the project structure can be easily handled. These indicators can be displayed again on the drawing board for a certain latent variable with the function show indicators ().

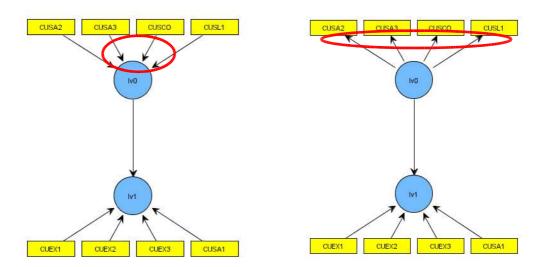
Note: The font of the latent variable is bold when the indicator variables are hidden.



· Reverse Link



The function **reverse link** changes the measurement model of latent variables from reflective (the arrows are heading from the latent to the manifest variable) to formative (the arrows are heading from the manifest to the latent variable) and vice versa (default setting: reflective measurement model).



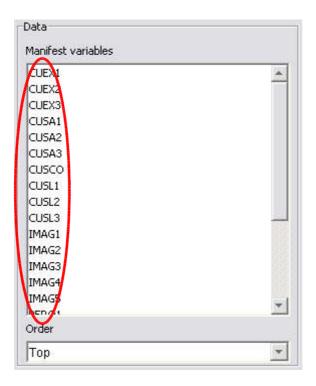
Arrange Indicators



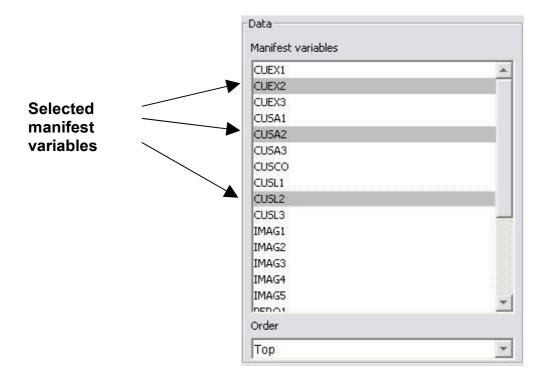
SmartPLS offers features to automatically order the indicators. Selecting above (), below (), left () or right () places the indicators in the corresponding position in relation to the selected latent variable.

4.3. Indicator Management

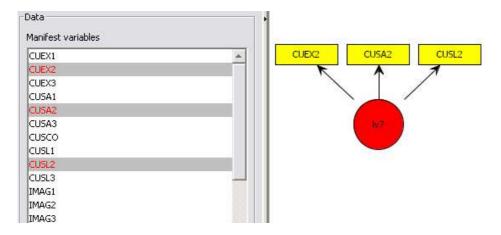
The imported manifest variables are listed in the box "manifest variables". They can be added to a measurement model of a latent variable on the drawing board by drag&drop.



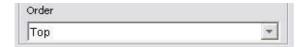
To do this, select a manifest variable by clicking on it (it is highlighted). Multiple manifest variables can be selected by pressing the [STRG] key and the left mouse button. A second click on this manifest variable removes the selection (the variable is not highlighted).



When selecting the last manifest variable, keep the left mouse button pressed, drag the indicators on a chosen latent variable on the drawing board and drop them. Thus, the manifest variables become part of the measurement model of latent variables. The font of these indicators, listed in the manifest variables box, changes from black to red in order to indicate that these variables are already part of the model.



Before dragging and dropping the selected manifest variables, their location with regard to the latent variable can be specified (see **arrange indicators**).



Hint: The direction of the arrow pointer of additionally added indicator variables depends on the measurement model of a certain latent variable (see also **reverse link**).

5. Extended Menu Bar

If at least one SmartPLS model is opened, the extended menu bar appears in the menu bar. Beside the basic functions (that can also be accessed via the tool bar and/or the context menu), additional functions are available for the current model.



5.1. Edit

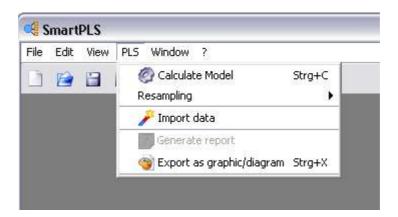
The descriptions for this option in the menu bar can be found in sections 4.2.2. *Tool Bar* and 4.2.3. *Context Menu*.

5.2. View

The descriptions for this option in the menu bar can be found in section 4.2.2. *Tool Bar.*

5.3. PLS

After the creation of a path model, several options for the model measurement and evaluation are available in the menu bar under *PLS*.



5.3.1. Calculate model

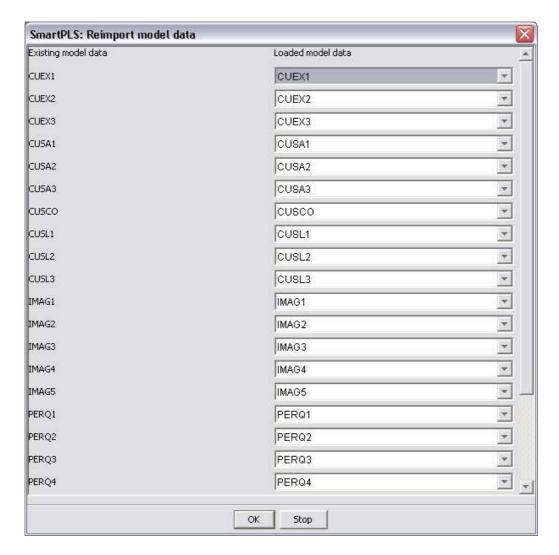
This option starts the model measurement with the PLS-algorithm. The measurement results are displayed in the model once the calculation is completed.

5.3.2. Resampling

This functionality will be available, soon.

5.3.3. Reimport of Model Data

The indicator variables can be updated with a changed/new CSV data. First, a CSV-file must be selected (see section 3.1.). Then, a dialog opens that allows to manually map the data already existing in the model file on the changed/new data in the CSV file (this is important if the original and the imported data have different names or sorting orders).



The left hand side displays the list of data already integrated in the model, while the indicators of the new/updated CSV-file appear on the right hand side. After finishing the assignment, press "OK".

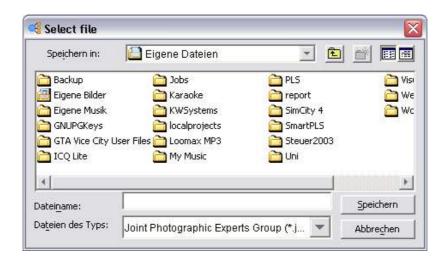
5.3.4. Report

It is possible to generate a report for calculated models. In this version of SmartPLS, only HTML as report export format is supported. After selecting a target folder, the report is generated in that folder. Just open the HTML file to see the results of the model calculation and evaluation. The report has different sections. All parts can be printed on paper in A4 format (and US-letter, soon). Additionally, all information of the report are saved in a CSV data files.

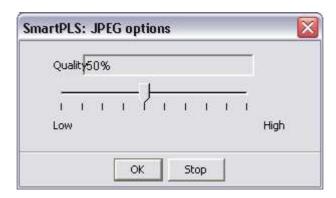


5.3.5. Export

The currently edited model can be exported to the following data formats: JPEG, TIFF, PNG, SVG.



If the JPEG format is selected, the quality of the picture may be specified (with a slider). This affects the resolution and the size of the exported JPEG file.



5.4. Window

It is possible to switch between all open windows in SmartPLS with the "Window" option in the menu bar.

6. Shortcuts

The following shortcuts can be used to accelerate and simplify the usage of SmartPLS:

Shortcuts	Functions
[STRG] + [A]	Select all objects in the drawing area
[STRG] + [B]	Move object in the background
[STRG] + [C]	Calculate Model
[STRG] + [D]	Delete object
[STRG] + [F]	Move object in the foreground
[STRG] + [G]	Group object
[STRG] + [H]	Hide indicators
[STRG] + [I]	Align indicators above (the latent variable)
[STRG] + [J]	Align indicators on the left side (of the latent variable)
[STRG] + [K]	Align indicators below (the latent variable)
[STRG] + [L]	Align indicators on the right side (of the latent variable)
[STRG] + [N]	Create new document
[STRG] + [O]	Open an existing document
[STRG] + [R]	Reverse link
[STRG] + [S]	Save Document
[STRG] + [T]	Grid on/off
[STRG] + [U]	Ungroup
[STRG] + [V]	Show Indicators
[STRG] + [X]	Export Model in graphic
[STRG] + [Y]	Redo
[STRG] + [Z]	Undo

Enjoy and model with pleasure – SmartPLS!