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Tosmana

Version 1.52

User Manual

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Content

1. Introduction

This manual contains a short introduction to the Tosmana software. Although this manual describes the basic features of QCA - the main method implemented in *Tosmana* -this is not a general introduction to the method. Please refer to the *Getting Started with TOSMANA* guide found on the website if you wish a short introduction to the main features of the software.

Currently, TOSMANA supports crisp-set QCA (csQCA) as first introduced Charles Ragin with his book "The Comparative Method"[1] and multi-value QCA (mvQCA). From Version 1.5., fuzzy-set QCA (fsQCA) is included with *Tosmana* as well.

Tosmana is work in progress and currently a sideline product of my work. Therefore, check all calculations performed with the software with other software packages prior to publication. You can find an overview of available software for QCA analysis on the Website of the Compasss group in the software section (http://www.compasss.org).

With the release of version 1.4., the development of Tosmana resumed after a number of years without work on the programme. Some few features were added, but the main changes from version 1.3 to 1.4 did consist in a clearing out of legacy issues in the software and general clean-up of code. Version 1.4 replaced the main window and redesigned the handling of data, allowing the direct import from a spreadsheet without the need to save the data. Version 1.5 introduces fsQCA to Tosmana.

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[1] Ragin, C. C. (1987) The Comparative Method. Moving Beyond Qualitative and Quantitative Strategies, University of California Press, Berkeley.

2. Using Tosmana

Tosmana comes as a ZIP-file. Simply extract the zip-file and run the file named *tosmana.exe.*

Please <u>only</u> download the file from the website (<u>http://www.tosmana.net</u>) and <u>check the checksum</u> to avoid a faulty download.

3. Constructing your data set

After the start of the software, the main window shows up, in which data files are created, loaded and saved, and from where the calculation window is called.

Loading and Importing Data

Loading a file into Tosmana

Load a file created (and saved) by *Tosmana* by selecting *File > Open* from the menu bar in the main window. Please note that only files created with *Tosmana* and saved in the XML (extended mark-up language) file format can be loaded with the *Open* item. If you have saved files with the extension *tosmana* in earlier versions of the software, you can still open them with the current software version.

Importing from Spreadsheet programmes

The easiest way to include data in *Tosmana* is to copy data directly from a spreadsheet programme. By selecting *File > Import from Clipboard* data can be directly pasted from a spreadsheet programme without the need of saving the data to a file.

In Tosmana, one variable always has to be included which can be used as Case-ID for your data set.

The first row must contain the variable names. To import the data, simply select the data to be used and copy it (to the clipboard). Then, in *Tosmana,* select *File > Import from Clipboard.*

In a first step, you should save the data as a *Tosmana* XML-file (*File > Save as*). The import features tries to identify the type of variables imported. If metric

data is included, you have to set thresholds before you can perform an QCA analysis. Please refer to the section on variable transformation for further information.

Creating and saving files

By selecting *File > New* a new *Tosmana* data set will be created. You can add variables to the data set by selecting *Dataset > Enter new Variable* from the menu bar. As soon as all variables are added, you can add the cases of the data set simply by entering them in the data matrix of the main window. To change the Variable name you have to enter the *variable edit* window described below.

Selecting File > Save in the main menu bar saves the data set. If you wish to use your data set in other applications (Excel or fs/qca) you may also save the file as a csv or dat file (choose *Export*). TOSMANA save the file in XML format.

Editing the data set

You might change the content of the data matrix at any time by changing the data in the main window. Please note that you have to re-open the mvQCA calculation window to use the new data in your calculation. If you want to add a new row (case), just enter the data in the last row of the data set. If you wish to delete a case, click on the row <u>header</u> of the case you wish to delete and press the delete button on your keyboard.

Adding and editing variables

To add a new variable please select *Dataset > Enter new variable*. Edit the name of the new variable and press *ok*. The new variable will then appear in the data set.

If you wish to change the attributes of an existing variable, please click on the *column* header and select *edit condition.*

- To change the name of the variable click on the button labelled *change name* and enter the new variable name.
- To remove a variable entirely, select the variable name in the *Variable Settings* window and press the button labelled *remove.*
- You may add a description to a variable in the *description field.*

Replacing multiple data entries

If you wish to replace multiple data cell entries with the same value, you may do so using the replace function (select *Edit > Replace)*. Define the search value and the new value to replace it and select all variable where this replacement is done. Press *ok* and the replacement will take place.

Variable transformation

The menu item *Transformation* in the *Variable Settings Window* defines how to convert the raw data to data used by mvQCA. There are four different options, which can be set for each variable:

- *use original values (1:1):* Using this option indicates that the raw data is used as it is with mvQCA. Please note that all data must be of numerical type and that missing data always has to be noted with an '-'. Variables containing the name of the cases should be changed to *use as case ID*. If this is not the case Tosmana will produce errors.
- *no Transformation possible:* If this option is set, the variable can not be transformed and it can not be used with the software. The sense of this is to exclude variables which can not be translated by the standard rules yet but which may be used in future (like calendar dates etc.)
- *use as case ID:* If this variable is set, the variable can only be used as case ID.
- *use Thresholds:* If this variable is set, you can use the threshold setter described below to set the thresholds dynamically while working with TOSMANA. Please note that all data must be of numerical type and that missing data always has to be noted with a '-'.

Transforming Scale Data

To transform scale data to stepped conditions suitable for mvQCA analysis, thresholds must be set to recode the data. TOSMANA provides two ways to do so: Thresholds can be set directly by hand or thresholds can be set interactively by using the 'Thresholdssetter'.

To set the thresholds directly, choose *Edit > Variable Settings* from the menu bar and select the condition to set the thresholds (double click the row header). If the option "use thresholds" is selected as transformation mode, the button *edit* can be pressed. The thresholds are entered by using '.' (dot) to separate decimals and ';' to separate multiple thresholds.

Using the "Thresholdsetter" Window

If one or more Variables do contain metric scaled data, the data must be transformed to an ordinal scale before it can be used with cs- or mvQCA. To do this, the variable must be set to be transformed with threshold(s) in the *Variable Settings* window (set the *Transformation* item to *use Thresholds).* Then the *Threshold Settings Window* can be opened with *Tools > Thresholdsetter* in the main window.
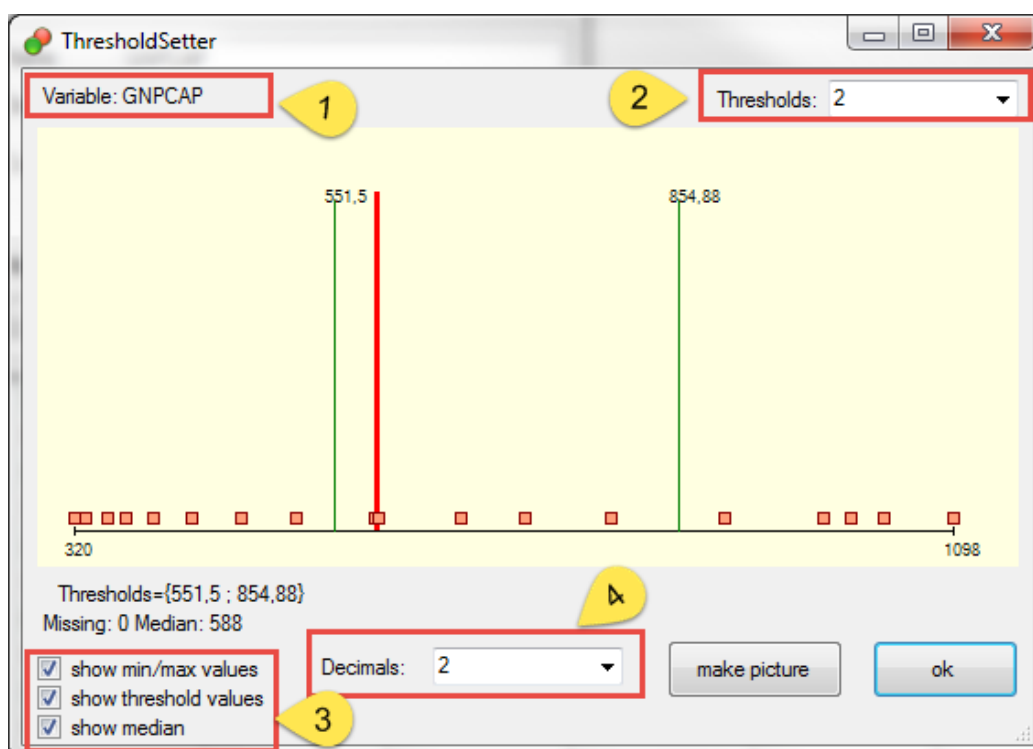
In the central panel the distribution of data is shown. Each orange box represents one case. The green lines represent the current thresholds. The values of the thresholds are noted above the threshold line if the option is set (lower left corner, *show threshold values*). The number of decimals shown can also be set (4). The thick red line is the median (the line can be toggled on / off with the option in the lower left corner (3)). The name of the variable edited is shown in the upper left corner of the window (1).

The number of thresholds used with the variable can be selected with the dropdown list in the upper right corner (2).

To move a threshold simply place the mouse on the wanted threshold (the mouse pointer will change) and press the left mouse button. The move the line by moving the mouse (still pressing the left button) and release the mouse button with the value wished.

Recode Conditions

To recode a condition into a new condition, select *Tools > Recode Condition* from the menu bar. Select the condition to be recoded and check the proposed name of the new condition. By selecting the "old" values found in the left box, these might either be used unchanged in the new condition (*"1:1"* button) or assigned new values (enter the new value in the text field under the *Convert to* button and press this button.

4. Data Analysis: csQCA and mvQCA

One of the main goals of *Tosmana* is to perform minimization on Boolean and on Multi-Value Data sets. This is done from the analysis window (named *(mv)QCA*). Call the analysis window from the menu bar: *Tools > Start (mv)QCA* or by pressing *F9*.
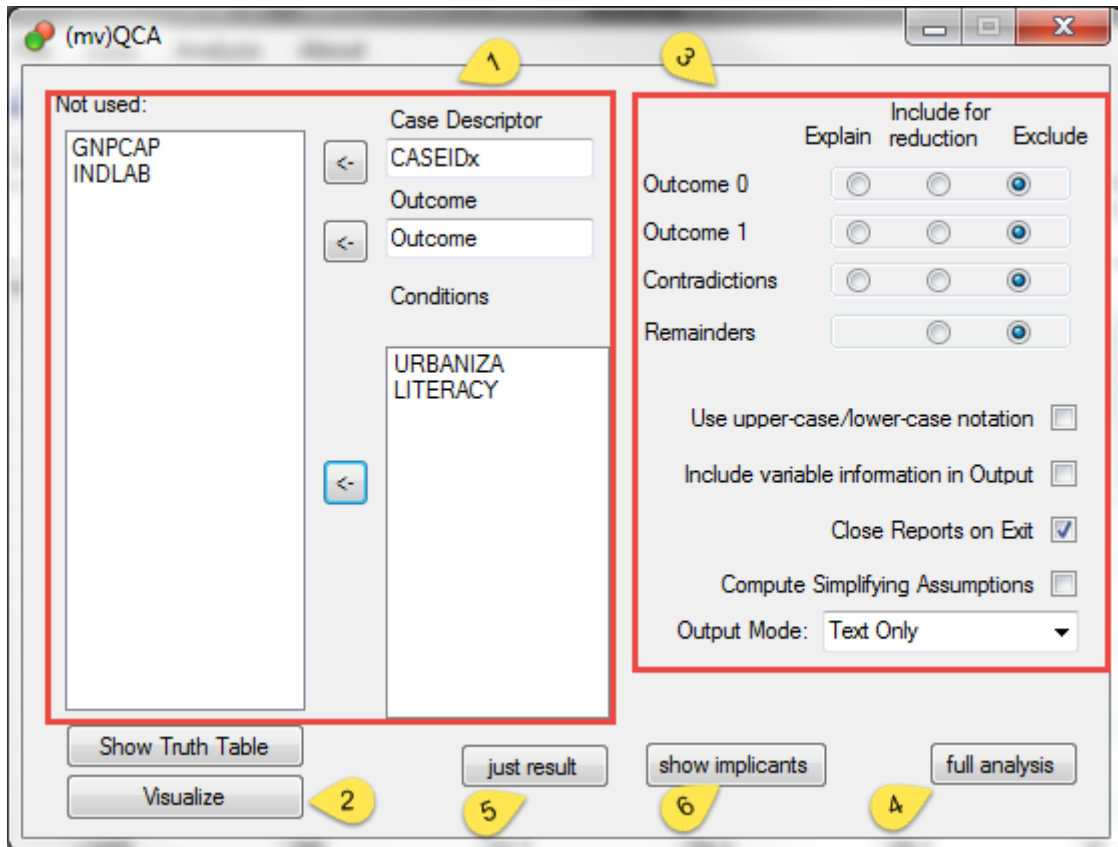
Selecting variables for analysis

Before the calculation can be done, the variables for the analysis have to be chosen (1). Use the arrow buttons to select the outcome and the conditions. Please note that the use of a case descriptor is necessary in *Tosmana.* Variable values have to be of the type {0,1} for Boolean analysis and {0,..,n} for multi value analysis. If you choose a variable with non-numerical data as outcome or condition, an error window will show up.

Visualizing your data

Up to five conditions can be displayed in a graph by pressing the *visualize* button (2). See the chapter on the Visualizer below for details.

Calculation configuration

The configuration of the calculation can be set in the right half of the *(mv)QCA* window (3). The configuration labels are to be understood as follows:

- *Explain:* Those outcomes which are explained by the solution.
- *Include for reduction:* Outcomes allowed to be included in the reduction of the implicants as logical remainders ("don't cares").
- *Exclude:* Outcomes, which are excluded from minimization.

Regularly, Tosmana shows the expressions in the solution with set notation. If the option *Use upper-/lowercase notation* is checked, the notation found in the discussions of QCA by Charles Ragin is used.

If you wish to see the used simplifying assumptions, enable the *compute simplifying assumptions* checkbox. With a large number of conditions this feature can be time demanding.

Starting the calculation

Start the calculation with the *Full Analysis* button (4). If the *output mode* is set to "text only", the results will be shown in the results window (see below). Else, the result report will appear in a new window of the *Internet Explorer.* If you only want to see the QCA results, these can be quickly derived by pressing the *just results* button (5).

Only Show Implicants

To only get a list of the prime implicants press the *show implicants* (6) button. In the prime implicant window coming up you can then see the prime implicants for your selection of conditions and settings. You may filter the list by cases. With a click on a prime implicant in the list the cases implied by this implicant are shown.

The Tosmana Report

When the calculation is finished, the result report opens in the Tosmana result window or, if selected, in the standard web browser.

You will find the settings of the calculation and (if selected) the data matrix first in the report. At the end, the solution and (if the option is set) the simplifying assumptions are reported. *Tosmana* can either use upper-/lowercase notation to display the results or use strict set notation. As *Tosmana* also allows more than two possible values for each condition, the upper-/lowercase solution can only be used to display strictly dichotomous data sets.

Copy any parts of the report to the clipboard by clicking the right mouse button and selecting *copy* in the popup-menu.

In addition, you can directly add solutions to the Boolean Calculator by highlighting the solution and selecting *Add to Boolean Calculator* from the context menu pressing the right mouse button.[2]

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[2]　　Currently this only works with dichotomous data sets. The use of set notation in the report is required (unselect the *Use Uppercase / Lowercase notation* option in the mvQCA window.

5. The Visualizer

Tosmana allows the user to display a Boolean data set with up to five independent conditions to be displayed graphically. To do this, select the conditions in the mv*(QCA)* window and press the *visualize* button.

Please note that at the recent stage it is only possible to save the created graph as a bitmap file, which is rather large, but this can be edited and compressed in almost every graphic application.

In the Visualizer, you can toggle between Colour and Black/White display and select which information is shown. You might also highlight or prime implicants solutions of your choice.
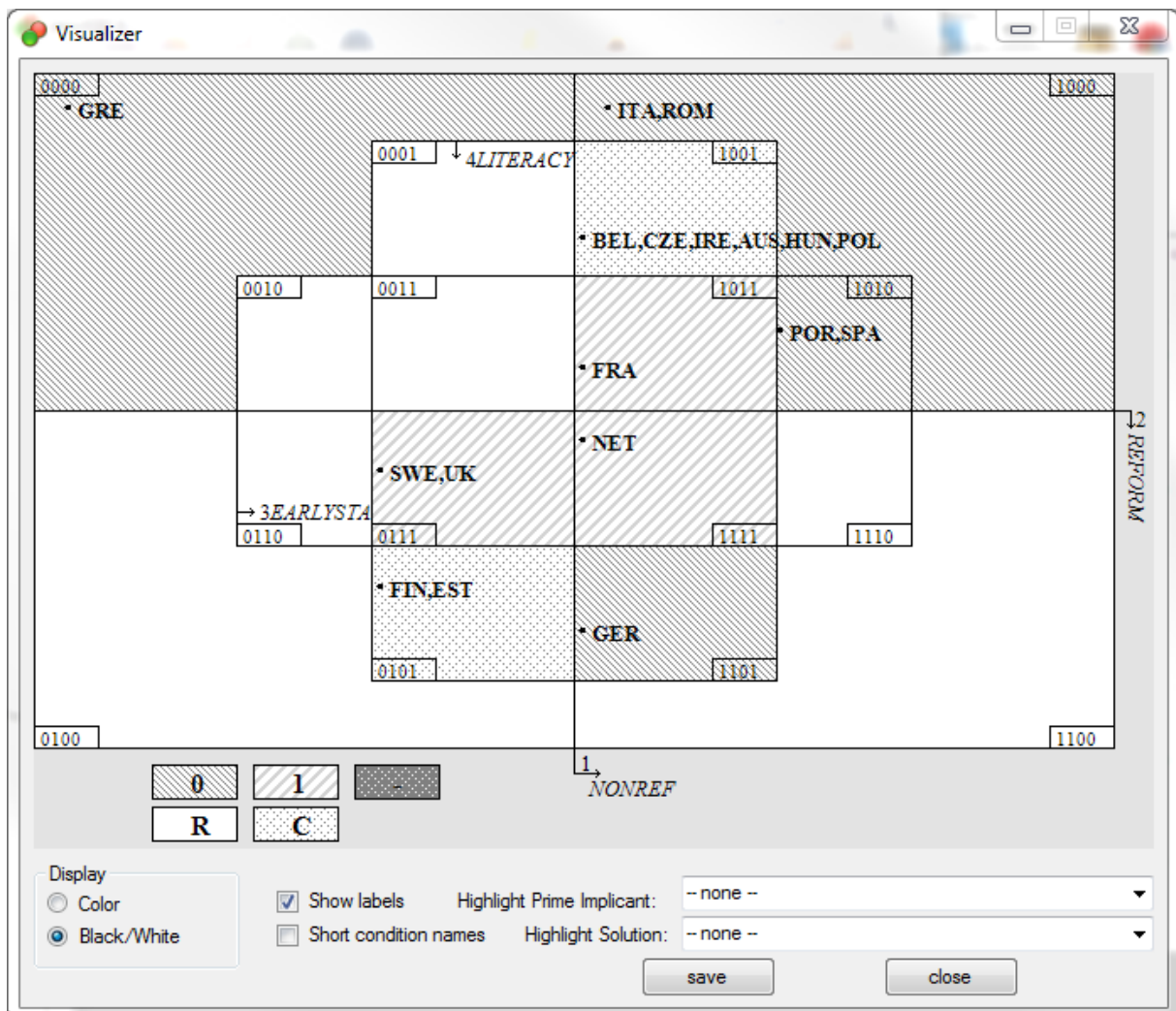
6. The Boolean Calculator

The Boolean Calculator allows simple calculation on Boolean Expressions like intersections and complements. To perform such a calculation, the Boolean Expressions have to be entered into the calculator. This is done in prefix notation just like using a standard pocket calculator: First the single expressions are entered which then are connected by + and *. When the logical expression is entered, it can be added to the lower calculation box by pressing the "add" button. An intersection of two logical expressions is calculated by selecting the two expressions from the expression list (using the shift key to select multiple entries) and then pressing the "computer intersection" button. The complement of a logical expression can be calculated by selecting the expression from the list and pressing the "compute complement" button.

Logical expressions can be directly added from the TOSMANA report by highlighting the solution and selecting *Add to Boolean Calculator* from the context menu pressing the right mouse button.

7. Data Analysis: fsQCA

From version 1.5, TOSMANA also enables users to perform standard fsQCA calculations. Please press *F10* or select *Analysis > Start fsQCA* from the menu bar and the *fsQCA* window appears. Similarly to the *cs-* and *mvQCA* analysis, the variables for the analysis have to be chosen (1) and the outcome value to be specified has be selected (2).
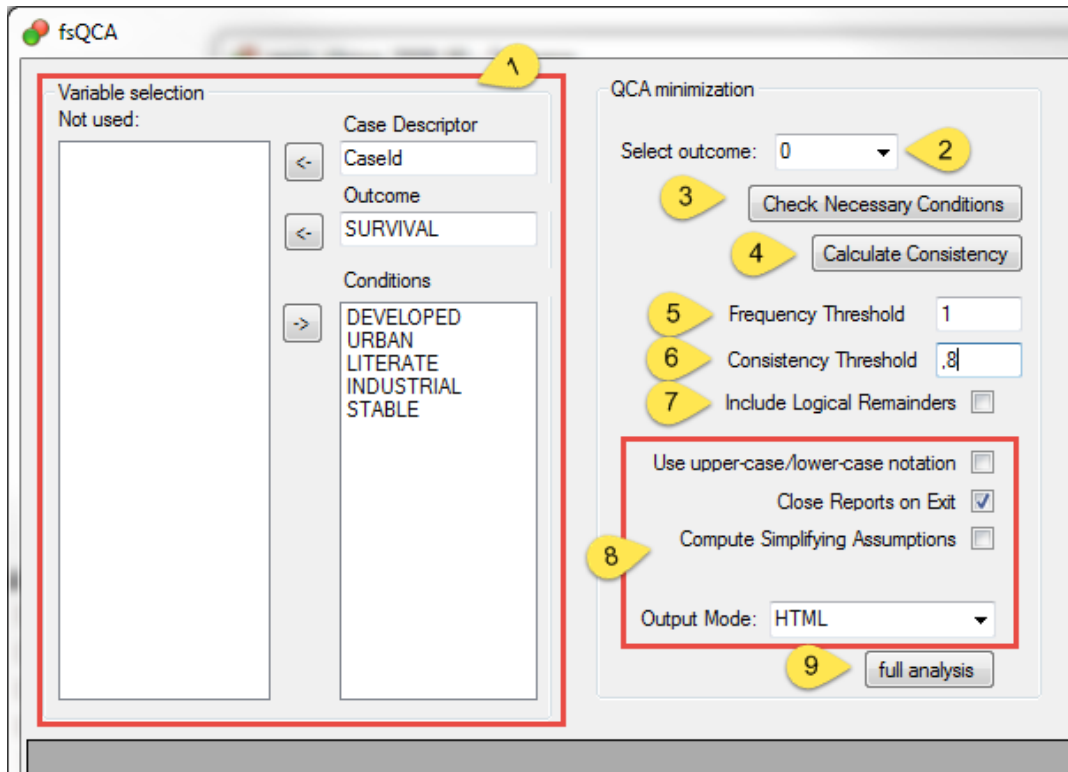
In a first step then, the software allows to check for necessary conditions (3). In addition, the *fsQCA* truthtable with consistency values can be calculated (4). To perform a full *fsQCA* analysis, please define the consistency cut-off (6) and the frequency threshold (5) press the *full analysis* (9) button. A number of further option can be set as with the *csQCA* analysis described above.

The XY Plot window

In addition to the analysis of consistency addressed above, TOSMANA also allows to study fuzzy set relations. To do so, please open the XY Plot from the main window (Analysis – XY Plot, or F8). One or multiple variables can be included on each axis (1) – select multiple variable by keeping *ctrl* pressed while selecting. Press the *create plot* button (2) to draw the XY Plot. In addition, the software calculates the consistency and the coverage values for the fuzzy set relation (X $\leq$ Y).
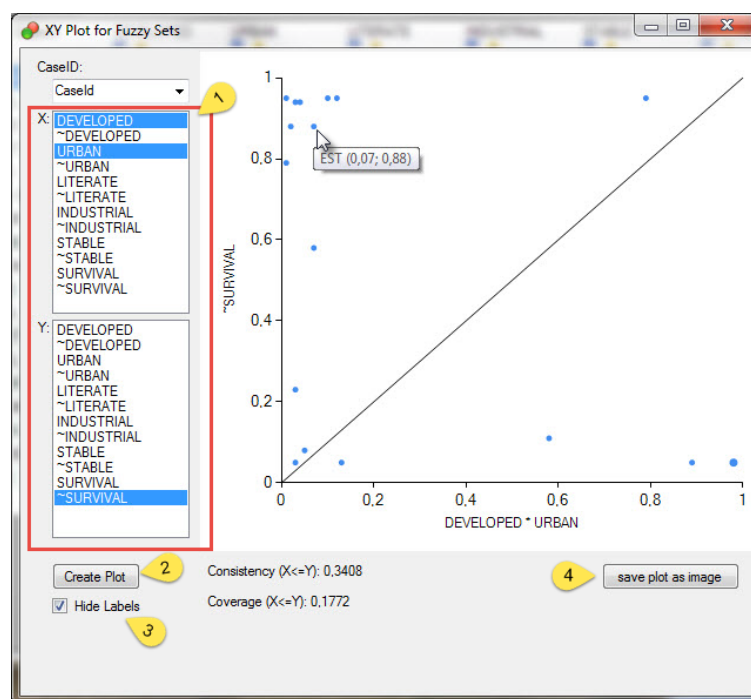
Single points in the plot show the individual cases. Cases sharing the same values are combined to a single, larger point. Hover the mouse over a point to see the case ID and the values of the case(s). To show all data, deselect the checkbox *hide labels* (3). Save the shown plot as an image by pressing *save plot as image* (4).

8. About the software

Tosmana is freeware and it comes as it is: There is no guarantee for correctness of any part of the results provided by the program.

Tosmana is work in progress and currently a sideline product of my work. Therefore, all calculations performed with the software should be <u>checked with other software packages</u> prior to publication. An overview of available software for QCA analysis can be found on the Website of the Compasss group in the software section (http://www.compasss.org).

Citing, Technical and contact information:

If you use *Tosmana* please cite like this:

Cronqvist, Lasse. 2016. Tosmana [Version 1.52]. Univ. of Trier. <[http://www.tosmana.net>](http://www.tosmana.net)

Please do also notice the following descriptions for a quick start with TOSMANA:

Cronqvist, Lasse. 2016: Getting started with TOSMANA. Univ. of Trier. <http://www.tosmana.net>

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