

# iMODELER 8.0

Quick Guide to the Visualization and Analysis  
of Complex Challenges with the iMODELER

“actually the most important tool in the  
world”

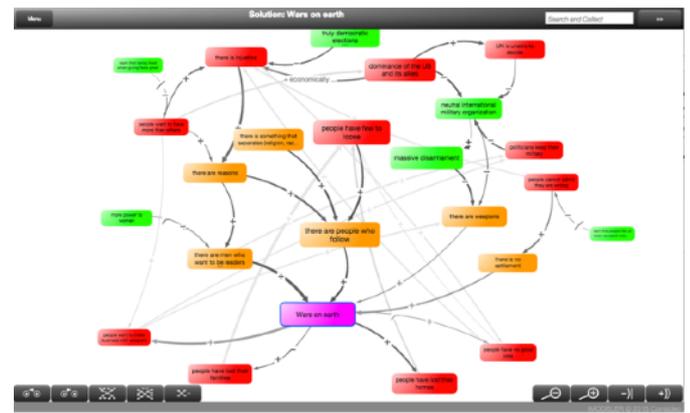
I think - therefore **iM**

The image shows the text "I think - therefore iM" in a bold, red, sans-serif font. The "i" and "M" are significantly larger than the other words. The "i" is stylized with a red rectangular bar at the top, and four red arrows point downwards from this bar towards the stem of the "i". The "M" is a simple, bold letter. The entire text has a slight drop shadow effect.

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## I. Why model? What is iMODELER?

When we are faced with an interplay of more than four factors we reach a universal mental limit according to studies. As a matter of fact in most of our challenges in politics, business and our private life we need to consider the interplay of many more than four factors. To overcome this mental limit we should thus visualize the interplay of many factors and not rely on gut feeling or best practice, both of which represent a surrender to complexity.



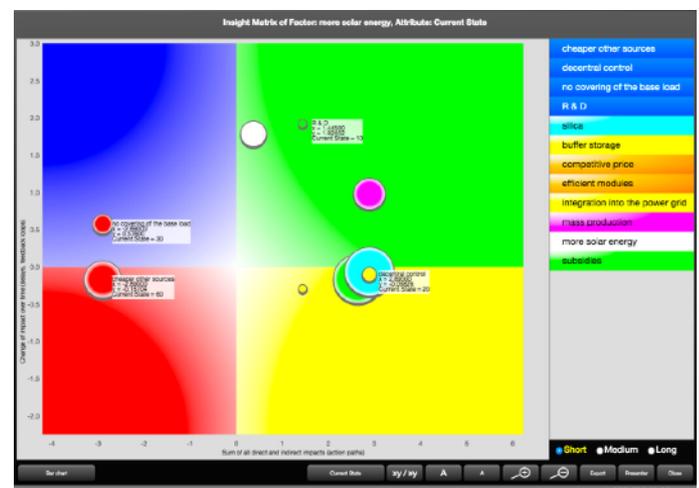
The iMODELER not only helps to visualize the interplay of potentially thousands of factors, it also allows you to analyze the consequences from a collection of arguments. As modelers, we put information and arguments into perspective and the tool shows us either

- qualitatively with the use of rough weighting of impacts what factors have a relatively larger effect on our goals and in turn which have a minor effect.
- or quantitatively with the use of data, formula and simulation how something will likely develop over time and to what extent.

Using the iMODELER for the visualization of arguments is extremely easy.

The applications range from school kids modeling a topic of interest to organizations and politicians identifying ways to make the world a better place.

Among countless other examples are individuals modeling their happiness, families modeling their choice of vacation, consultants modeling their client's individual challenges, or, of course, companies modeling possible strategies, projects, and processes.



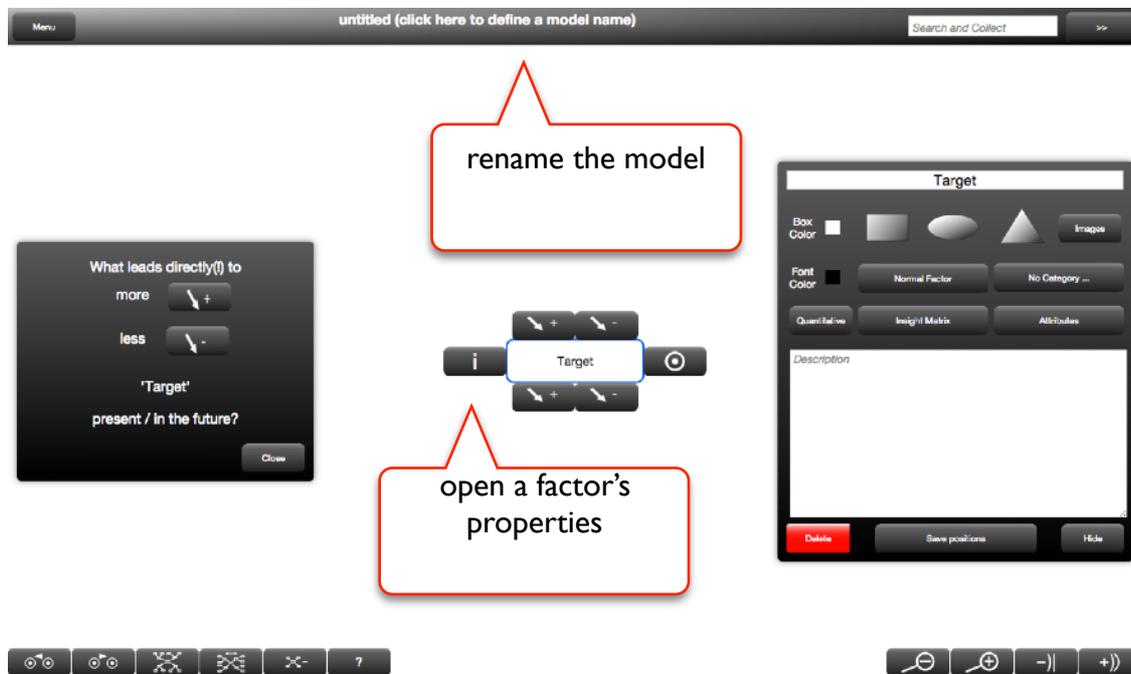
In order to develop useful models that include the necessary crucial factors relevant to our target, we can use the iMODELER's four KNOW-WHY questions and proposals from [KNOW-WHY.NET](http://KNOW-WHY.NET), the global brain for interconnections.

The current iMODELER is the result of many years of research and practical application. It works bionically like an enhancement of our own brain. We can model with all kinds of devices, even collaboratively. Everything is saved automatically and you don't even have to close property windows - just switch to another factor.

The iMODELER Service is web based and can also run on tablets and smartphones either as freeware ([www.imodeler.info](http://www.imodeler.info)) without access to quantification, collaboration and export features, or as the professional version with full capability. The desktop version (local installation, simulation of very large models but no collaboration or read-only links and only for Windows, Mac and Linux) only comes as a professional version. You can also access iMODELER Service from the desktop version and larger organizations can even request the iMODELER Server in order to host their own iMODELER Service.

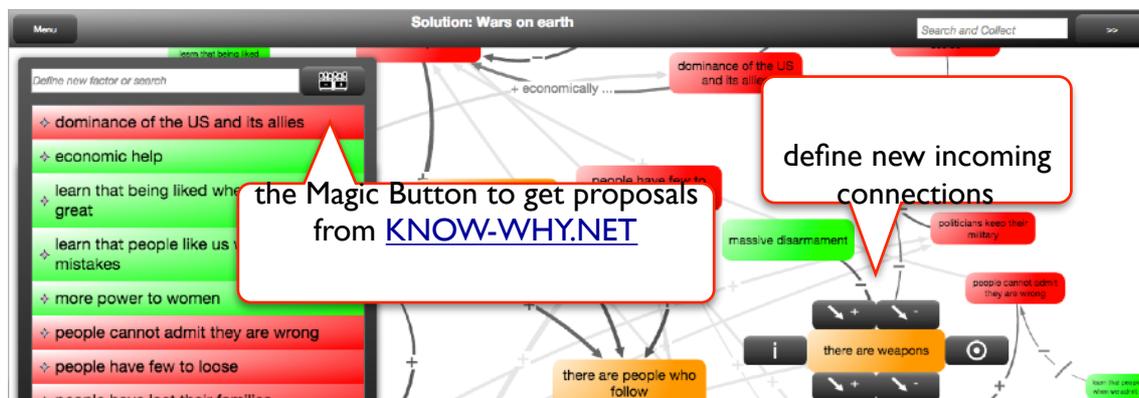
## 2. Qualitative Modeling and the KNOW-WHY Method: What has the biggest impact?

You start a model (either in your installed desktop version or using the iMODELER Service via [www.imodeler.info](http://www.imodeler.info)) by renaming the target factor (click on the factor and then the "i").



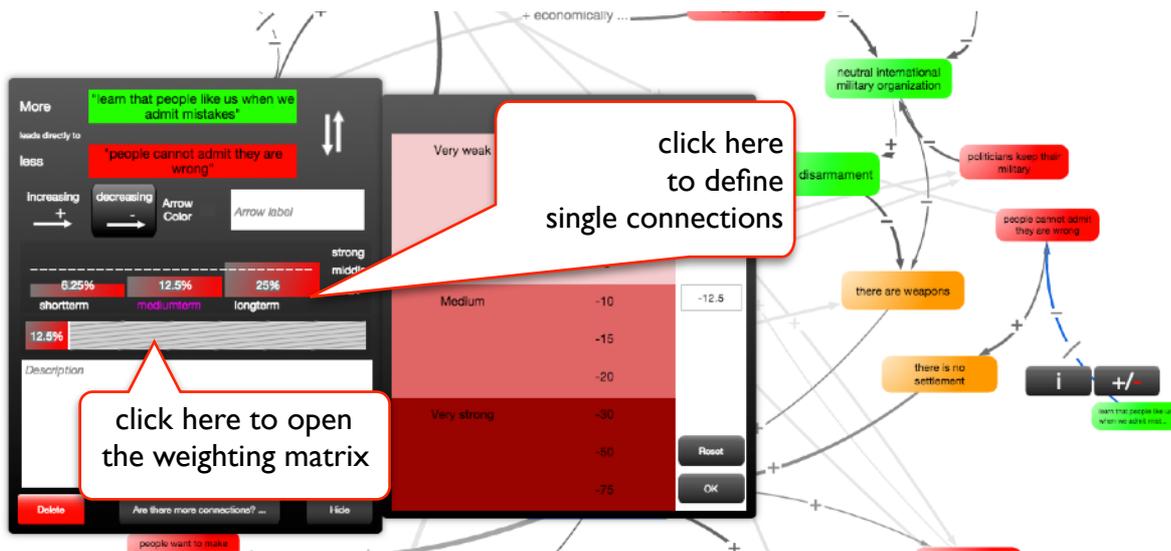
Define what should be reached. You can name the model via its title. The model, then, is saved automatically in a database (see Menu...Model Manager). You may import and export files to work with them as .imm files. To describe the model you can define its properties (via Menu).

Having named the target factor you can use the four KNOW-WHY questions to define what influences it and then continue to ask these questions for every subsequent factor until you have modeled and reflected measures which will help you to act successfully. You can use the Magic Button for proposals regarding further influencing factors from [KNOW-WHY.NET](http://KNOW-WHY.NET):



To define a new connection you can define a new factor, search for it from the list, or click on a factor you see in the background. (hint: you can collect unconnected factors via the search field in the upper right. Just type the factor name and press Enter.)

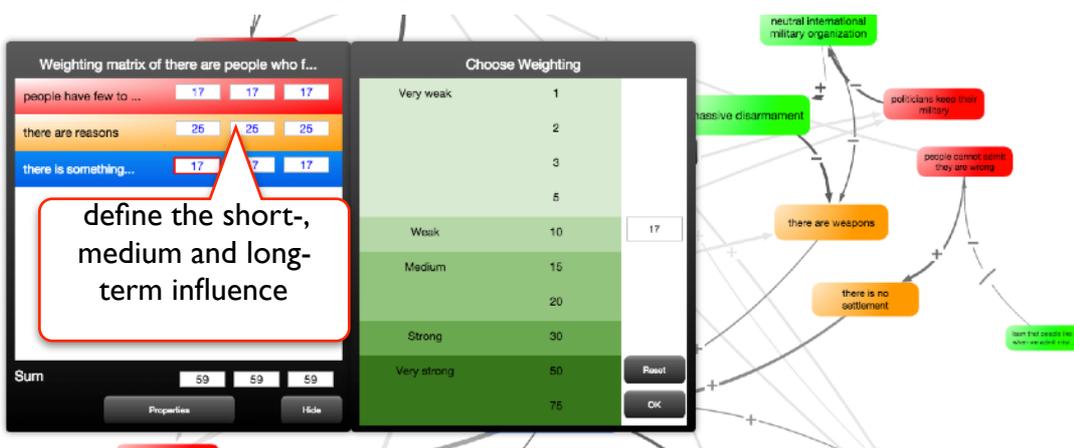
Having visualized all the interconnections you should then weight them qualitatively. Click on the connection and then the “i” to see its properties. You can either weight each incoming connection to a factor one by one...



click here to define single connections

click here to open the weighting matrix

... or you can use the weighting matrix to see them all at once:

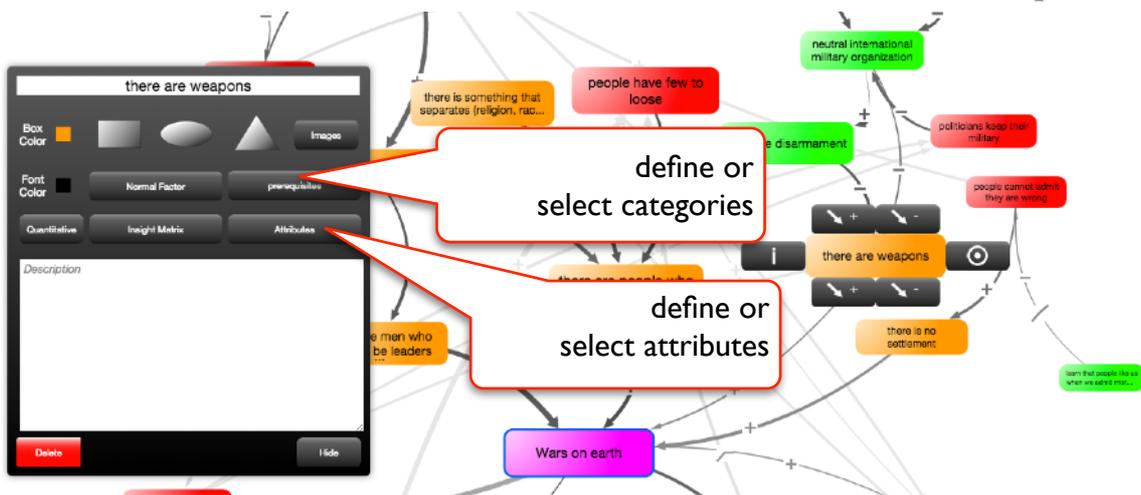


define the short-, medium and long-term influence

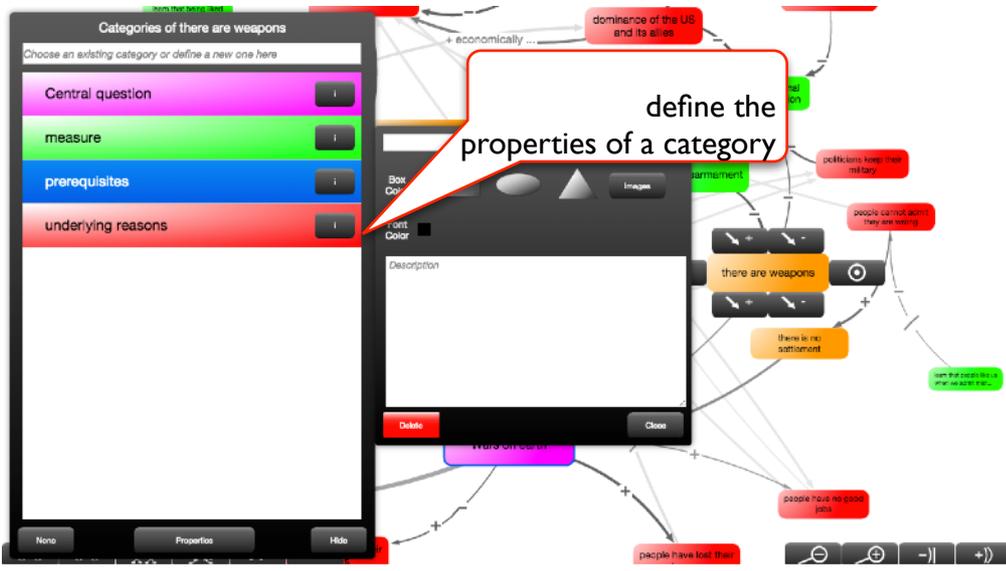
Qualitative weighting means that we define whether one factor's influence is stronger or weaker than that of others. You can consider them percentage values or decide to ignore the sum of influences onto a factor with regard to it being less/equal than 100, as this assumption is not necessary for the modeling. For an influence which represents a negative relation, put a minus in front of the value. Where a single influence falls on the spectrum between weak, medium and strong depends in part on the number of other influences.

The short-term influence is automatically applied as the value for medium and long-term as well unless you define them differently. The influences that have not been weighted individually automatically adapt their value to keep the sum at 100 (percent). If you decide that the strength of an influence changes from short- to medium to long-term this will be indicated with different symbols on the connecting arrows between the factors.

During the weighting of incoming connections or certainly at some point in the modeling process you should consider color coding the factors by differentiating between, for example, measures, resources, obstacles and so forth. You can either use a box color for each factor via its properties ...



... or you can use categories (their further use is explained in the next section) and define a color (and a shape or a picture) for each factor with the same category. (Note: you can use several categories but the first you select for a factor defines its properties)

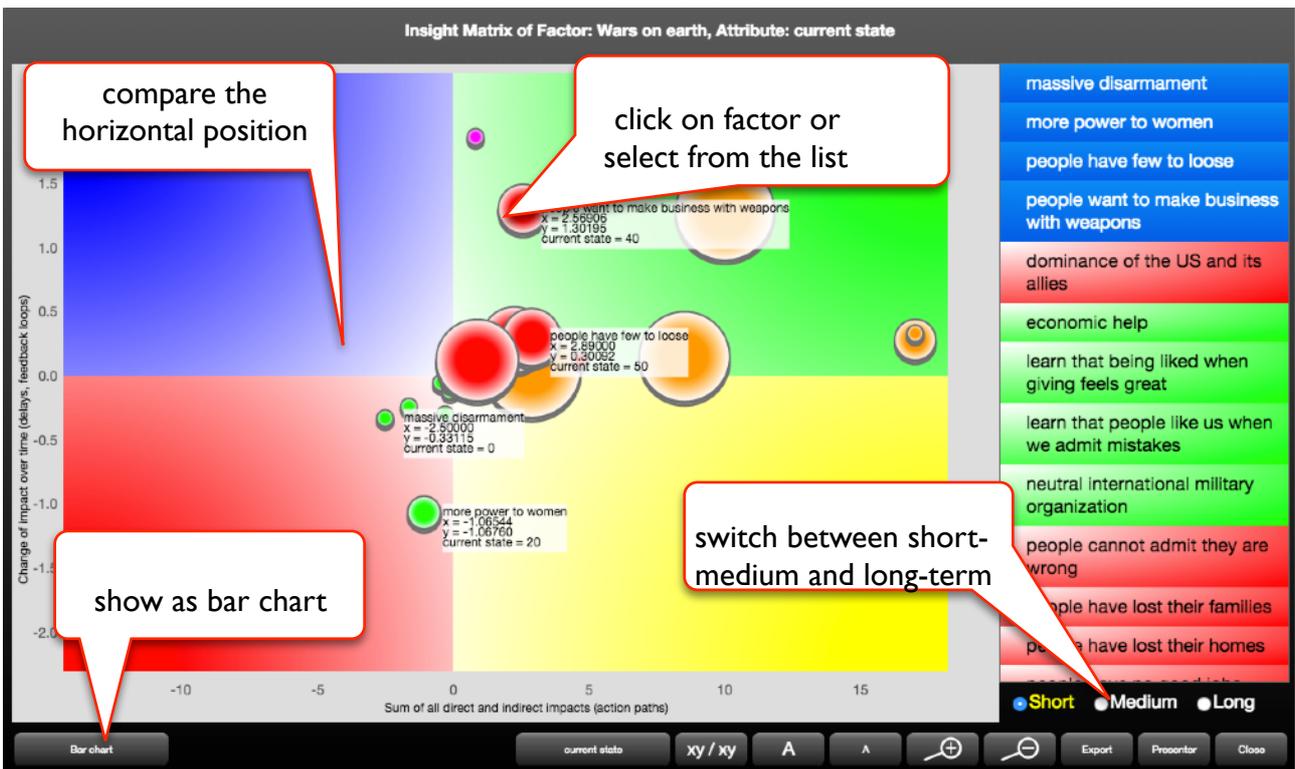


Sometimes it is useful to define further attributes for each factor. They allow you to, for example, describe the current state of a step within a project, the likelihood of an incident, or indeed whatever may be of interest. Next, with the analysis you can then see the importance and current state of these factors.

To analyze the qualitative model and visualize the consequences of the weightings and emerging loops (see Menu ... Loops), you can choose to see the Insight Matrix for any modeled factor you wish.

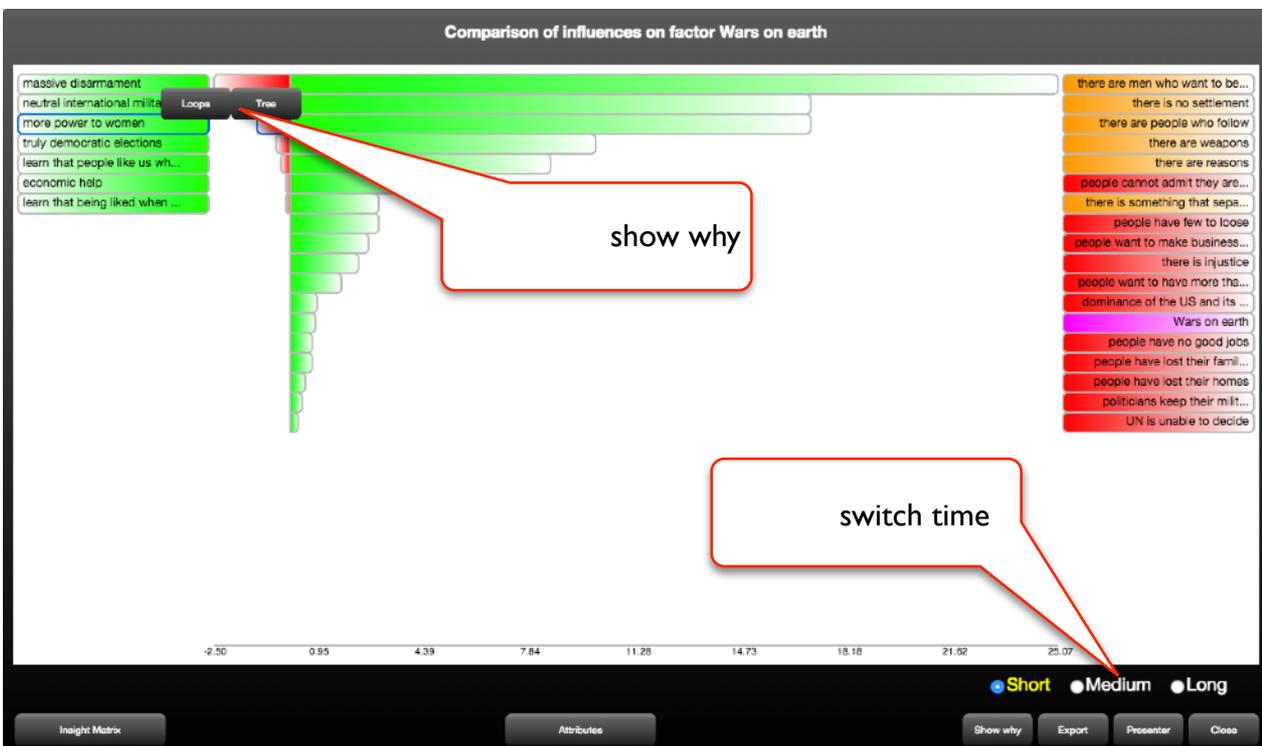
The Insight Matrix shows on its horizontal axis the sum of effects. This reveals the greatest risks or obstacles and what are the most promising measures to reach your goals.

The vertical axis indicates how the effect is going to change over time; whether it will increase, decrease or remain constant. Once you switch between short-, medium and long-term you will see the effect as the factors move within the matrix.



For the analysis you usually do not look at just one Insight Matrix. If you have identified, for example, measures for your target, you may look at their Insight Matrices as well in order to see how they themselves be dependent on other factors.

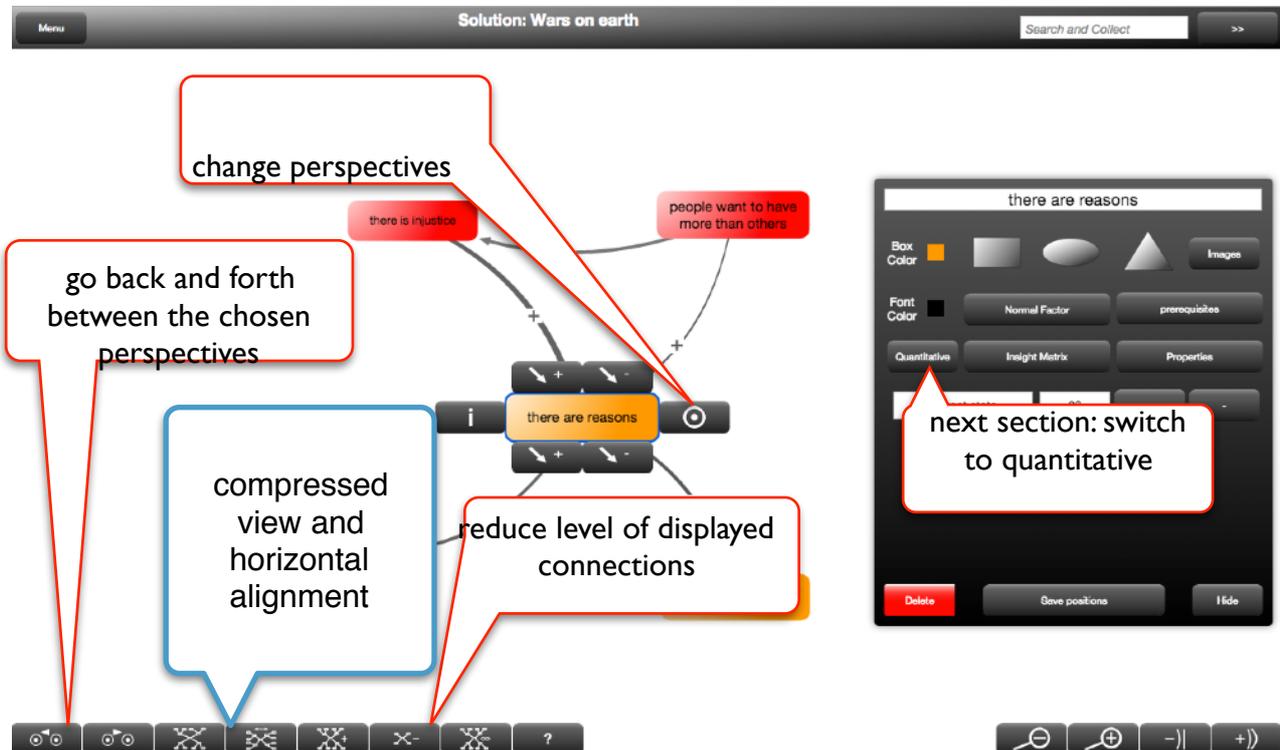
Looking at the Insight Matrix you may alternatively opt to see the bar chart view. From there you can click on any factor to see the Show-Why-Buttons that explain the total effect of a factor by showing which loops are affected by it and what impact chains it triggers.



### 3. Thousands of factors:

Filter, cluster, change perspectives, levels, compressed view, fisheye effect

The iMODELER allows you to model thousands of factors and their interconnections. As we do with our brain, the iMODELER approaches a challenge from a certain perspective (the factor with the blue outline) and then looks at what leads to this or to what it leads. Therefore, the iMODELER was created so that you can change the perspective and get different views on and of the model. After changing, navigating back and forth to the perspectives you have chosen is easy.

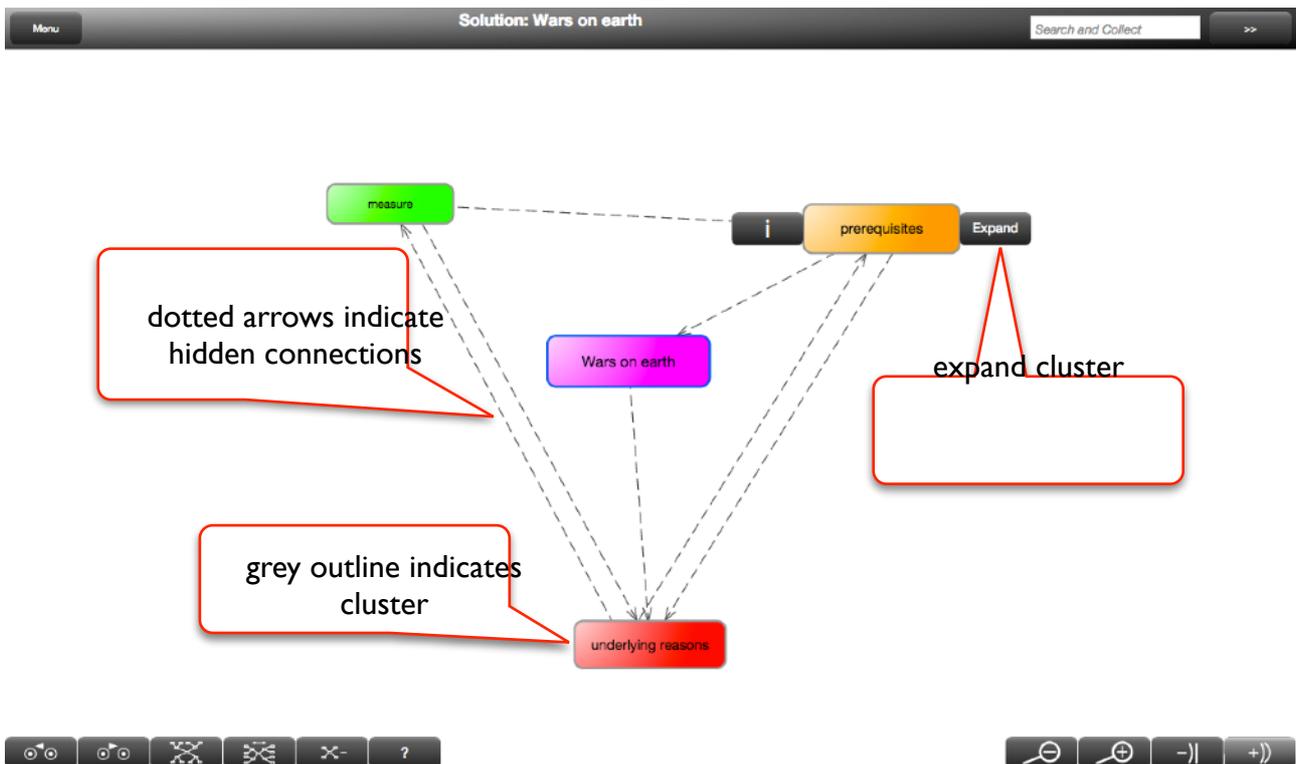


If you are overwhelmed or want to focus in on something and think too many connections are visible, you can hide levels of connections and opt to see just the factors that are directly connected to the factor that is currently in the center of the perspective. Level by level you can opt to see more connections.

The factors are positioned automatically (of great benefit when you model collaboratively and allows one to quickly build a model). However, you can move them to another position either temporarily or, via the properties of the factor currently in the center of the perspective, save their position. It is then saved for the current combination of levels, filters and clusters.

Depending on the perspective you won't see all the factors. Via Menu ... Show Unconnected you can see the unconnected factors.

The previously mentioned categories feature can be used to cluster and filter the factors of your model. Via Menu ... Filter/Cluster you can decide what to make visible. A cluster then means that all the factors within the selected category are summarized into one cluster factor (indicated by a grey outline).



Finally, you can use the fisheye effect, compressed view, or change between horizontal and vertical alignment of the model with the buttons at the bottom of the interface to customize your view.

#### 4. Adding information - iM-Document Manager

Soon to come the iM-Document Manager which allows you to attach files to factors and connections and ideally include their content while searching models and KNOW-WHY.NET.

#### 5. Communicating insights:

Presenter, report, read-only links, export models

The many views and Insight Matrices you find valuable can be collected in the iMODELER's Presenter (via Menu ... Presenter). There you can also add descriptions to each view you collect.

From the Presenter you can export a model report that shows a list of all factors and connections, their description and their formula (not available in the freeware version).

You have three options to share your model (Menu ... Share): you can provide others with a read-only link so they can explore your model without any license or registration directly in their browser (any changes they make won't affect your model)

....

#### 6. Collaborative Modeling

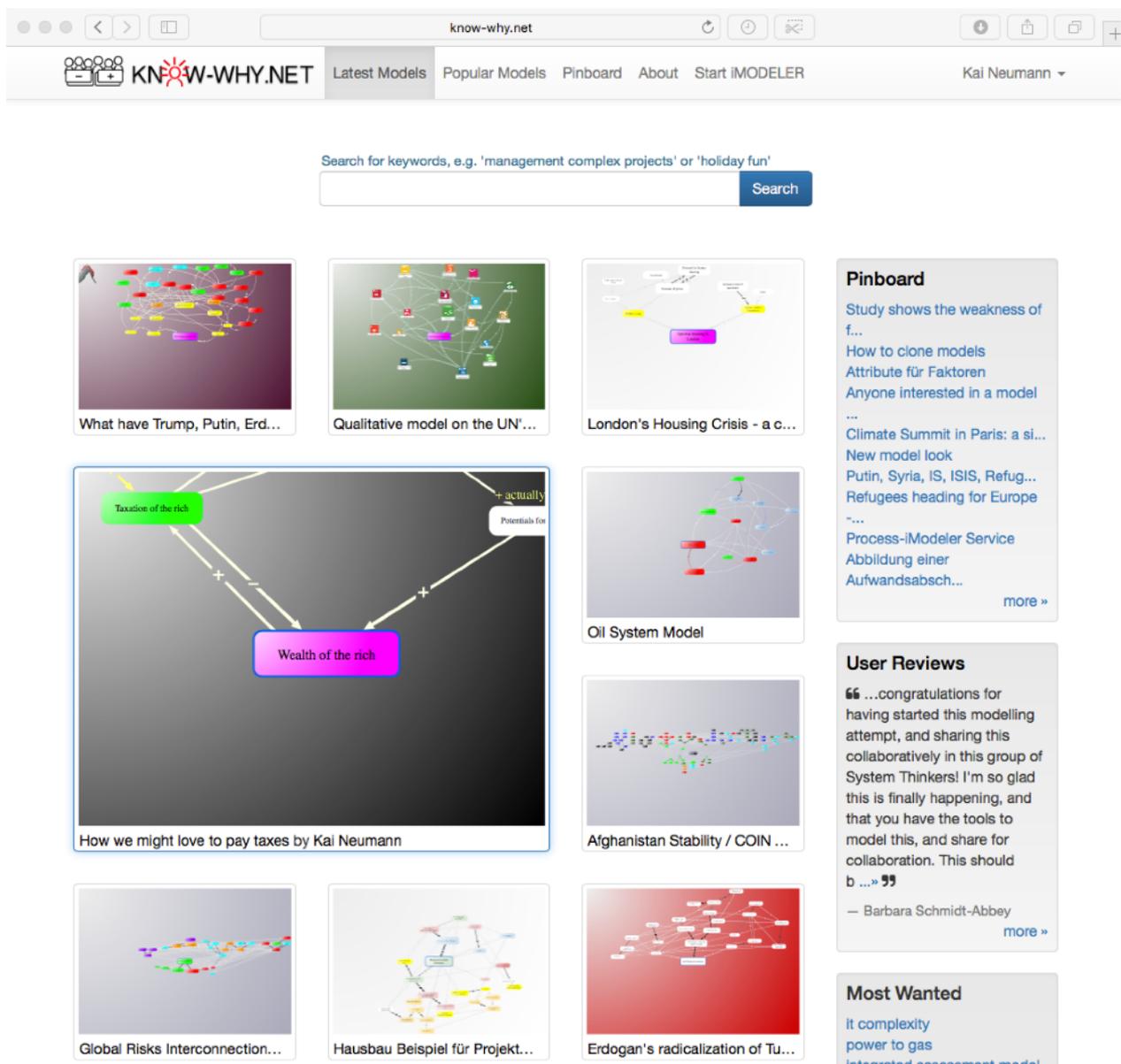
....

Or you can provide others with a powerful collaborative modeling link (not available in the freeware version). This allows them to simultaneously work on the same model. You can see in the changelog (Menu ... changelog) who has changed what. This has proven to be a useful feature even during a

modeling session in which the contributors are sitting in the same room with each one using her or his own laptop, tablet or smartphone to add to the model.

## 7. KNOW-WHY.NET

Finally, you can publish a read-only or a collaborative link on [KNOW-WHY.NET](http://KNOW-WHY.NET), where you can subsequently find the model(s). Perhaps more importantly it is worth knowing that factors found in the models on this platform are used as the proposals for influences when you click on the already mentioned Magic Button (Section 2, page 5). The more people that use your model or parts of it, especially if they rate it, the higher your rank within the modeling community will climb (you can define a profile on [KNOW-WHY.NET](http://KNOW-WHY.NET)) and the more helpful the proposals from [KNOW-WHY.NET](http://KNOW-WHY.NET) will become.



The screenshot shows the homepage of [know-why.net](http://know-why.net). At the top, there is a navigation bar with the site logo, a search bar, and menu items: Latest Models, Popular Models, Pinboard, About, and Start iMODELER. The user 'Kai Neumann' is logged in. Below the navigation is a search bar with the placeholder text 'Search for keywords, e.g. 'management complex projects' or 'holiday fun''. The main content area displays a grid of model thumbnails, each with a title and a small image of the model. The thumbnails include:

- What have Trump, Putin, Erd...
- Qualitative model on the UN'...
- London's Housing Crisis - a c...
- Oil System Model
- Afghanistan Stability / COIN ...
- Global Risks Interconnection...
- Hausbau Beispiel für Projekt...
- Erdogan's radicalization of Tu...

On the right side, there is a sidebar with three sections:

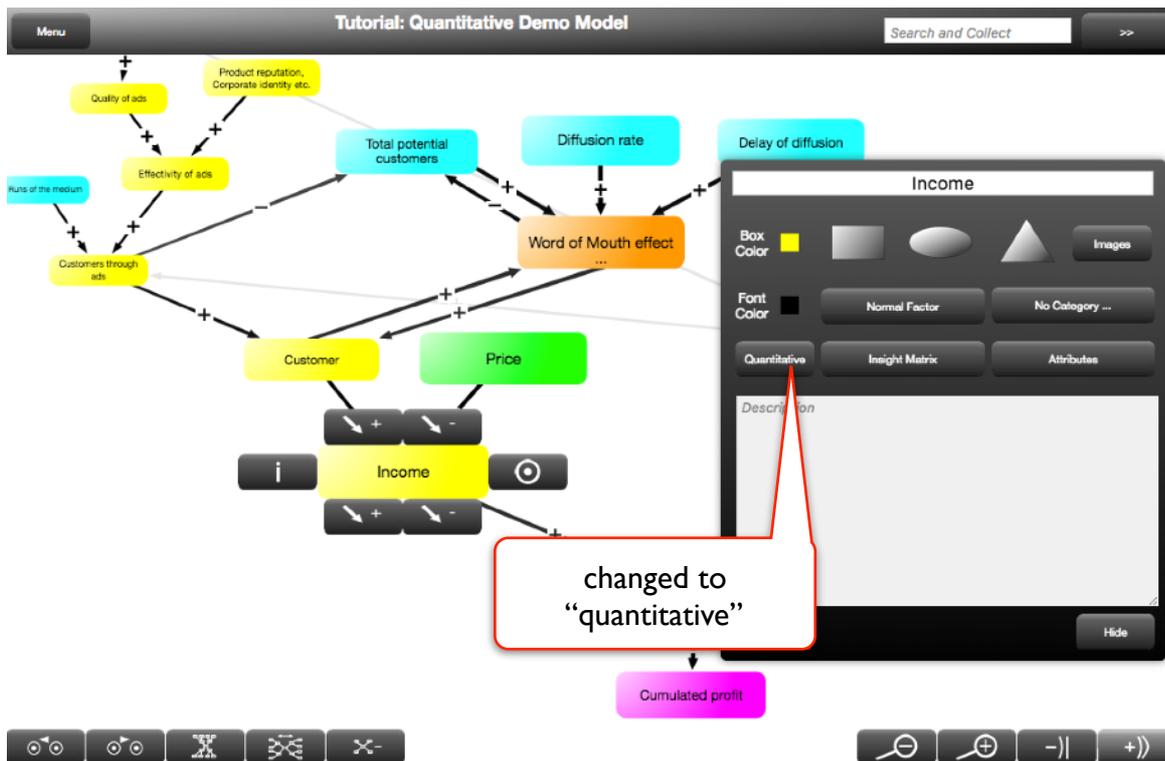
- Pinboard**: A list of model titles and snippets, including 'Study shows the weakness of f...', 'How to clone models', 'Attribute für Faktoren', 'Anyone interested in a model', 'Climate Summit in Paris: a si...', 'New model look', 'Putin, Syria, IS, ISIS, Refug...', 'Refugees heading for Europe', 'Process-iModeler Service', and 'Abbildung einer Aufwandsabsch...'. A 'more >' link is at the bottom.
- User Reviews**: A review by Barbara Schmidt-Abbey praising the collaborative modeling effort. The review text is: '...congratulations for having started this modelling attempt, and sharing this collaboratively in this group of System Thinkers! I'm so glad this is finally happening, and that you have the tools to model this, and share for collaboration. This should b ...'. A 'more >' link is at the bottom.
- Most Wanted**: A list of model titles, including 'it complexity', 'power to gas', and 'integrated assessment model'.

## 8. Quantitative Modeling:

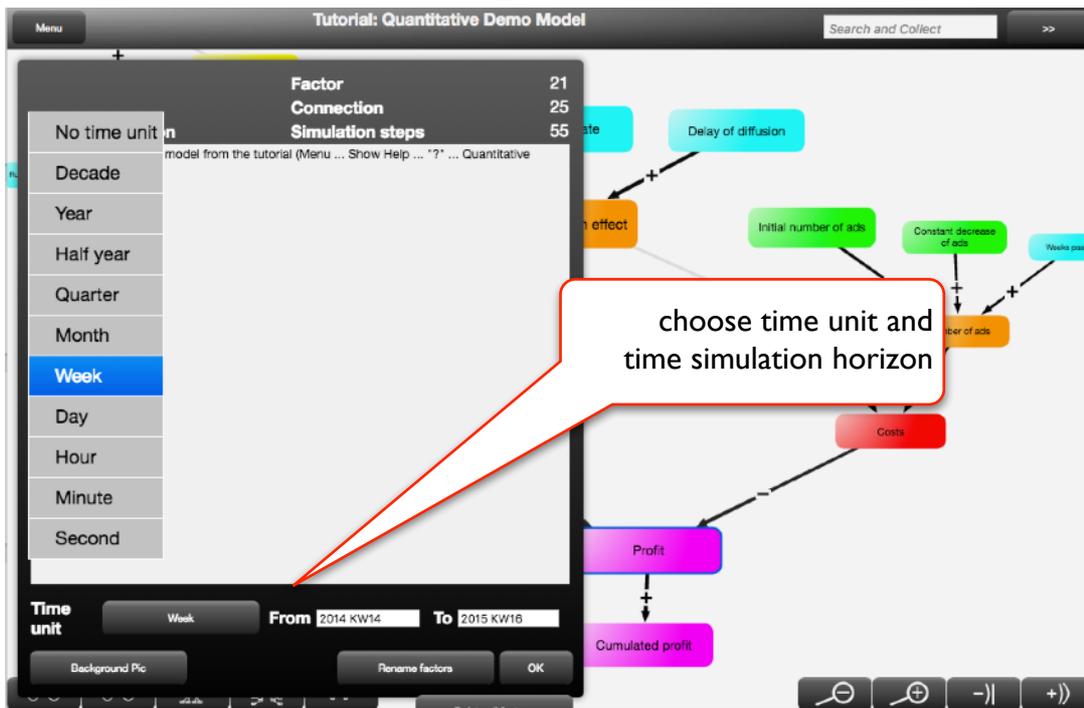
With what likelihood and to what extent will something develop over time?  
(System Dynamics and Discrete Modeling)

The quantitative features (sections 8 - 14) are not included with the freeware. However, if you have used them and share a link of your model others can still run scenarios without needing a license.

While qualitative models quickly describe interconnections through the properties of the connections, quantitative models use data and formulas once you have chosen to see the quantitative options in a factor's properties window:



The result of quantitative modeling is the simulation of values over a period of time with a certain time step, both of which are defined via Menu ... Model Properties. This is where you should start your quantitative modeling:



The formulas then describe for each time step what should be calculated. If you have Income and Expenses connected with Profit then the formula for Profit is:

$$\text{Income} - \text{Expenses}$$

Thus, at each time step the current Income minus the Expenses is calculated. If you want to sum the value over time it becomes:

$$\text{valuebefore}(0) + \text{Income} - \text{Expenses}$$

Formula like  $\text{valuebefore}()$  are explained within the formula editor and there you will even find system dynamics functions such as Stock, which describes inflows and outflows. By the way, although the iMODELER is based largely on concepts of system dynamics, it is not at all necessary to understand and you would in fact see that it also works without the normal restrictions of this approach.

### 8.1. Constant values (parameters) and time series

The simplest type of formula for a factor is a constant value, e.g. the interest rate of something. You should define separate factors with constants that are connected to factors with formulas where you need parameters. For example, if your interest payments are: current account balance \* 0.05, then you should define an explicit input factor for the interest rate and then change the formula to: current account balance \* interest rate. The reason is very simple. Later in the simulation cockpit you can display and manipulate input factors in order to run different scenarios. Parameters within a formula would remain hidden, therefore it is best to make them explicitly separate. These kinds of factors we can call exogenous factors as they are not influenced by the rest of the model (like endogenous factors with formula or relations would be).

Another way of defining exogenous factors is the use of time series. You can explicitly define values for each time step, import them or roughly sketch them. A powerful way is to use Delete All and Auto Fill in order to define discrete values (events) in time:

Menu **Tutorial: Quantitative Demo Model** Search and Collect >>

Improvement of quality of ads

**Investment into quality of ads [EURO]**

Auto Fill Delete all  
Distribution Import

Formula Values EURO

|           |   |
|-----------|---|
| 2014 KW15 | 0 |
| 2014 KW16 | 0 |
| 2014 KW20 | 0 |
| 2014 KW21 | 0 |
| KW22      | 0 |
| KW23      | 0 |

15000  
10000  
5000  
0

2014 KW28 2014 KW45

Time

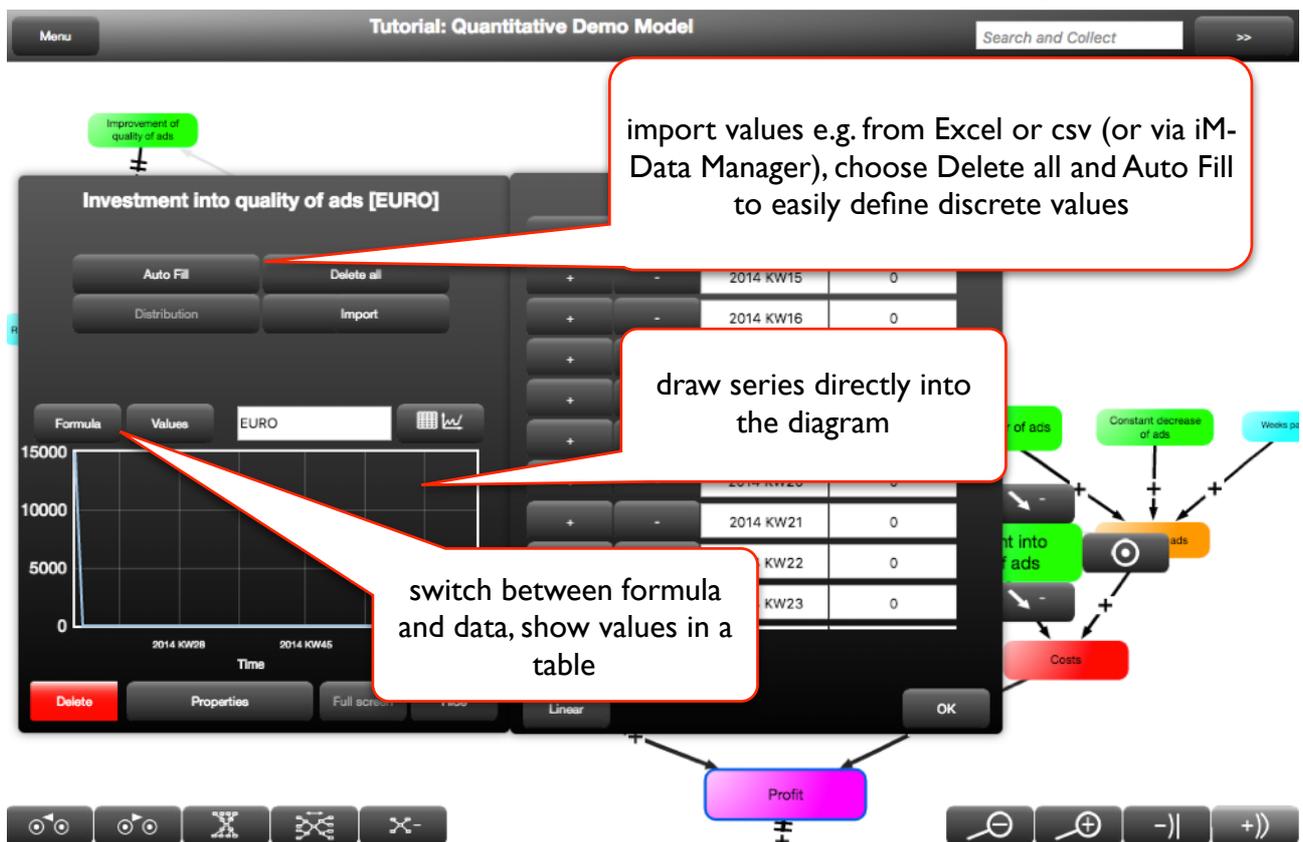
Delete Properties Full screen Linear OK

draw series directly into the diagram

switch between formula and data, show values in a table

import values e.g. from Excel or csv (or via iM-Data Manager), choose Delete all and Auto Fill to easily define discrete values

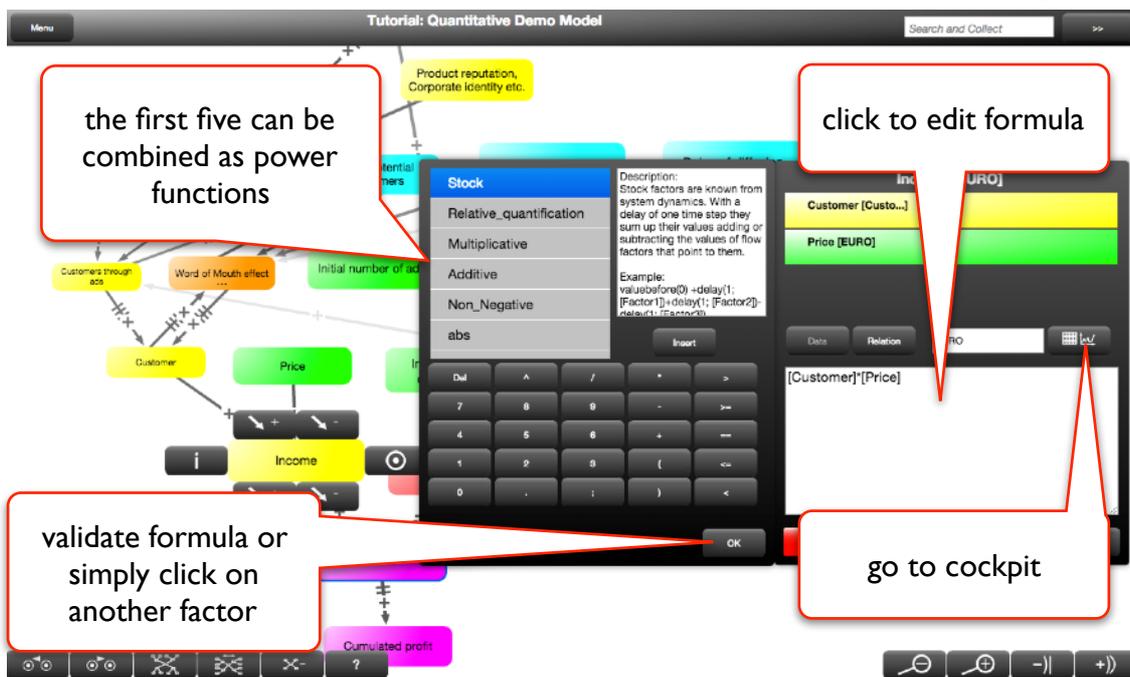
Profit



## 8.2. Formulas

Formulas can be both very simple or highly sophisticated. In most cases, however, they are quite simple. To include factors that are connected to the current selected factor you can simply click on them from the list. To see if a formula is valid you can either click on the OK button in the formula editor or you can choose quantitative validation from the Menu.

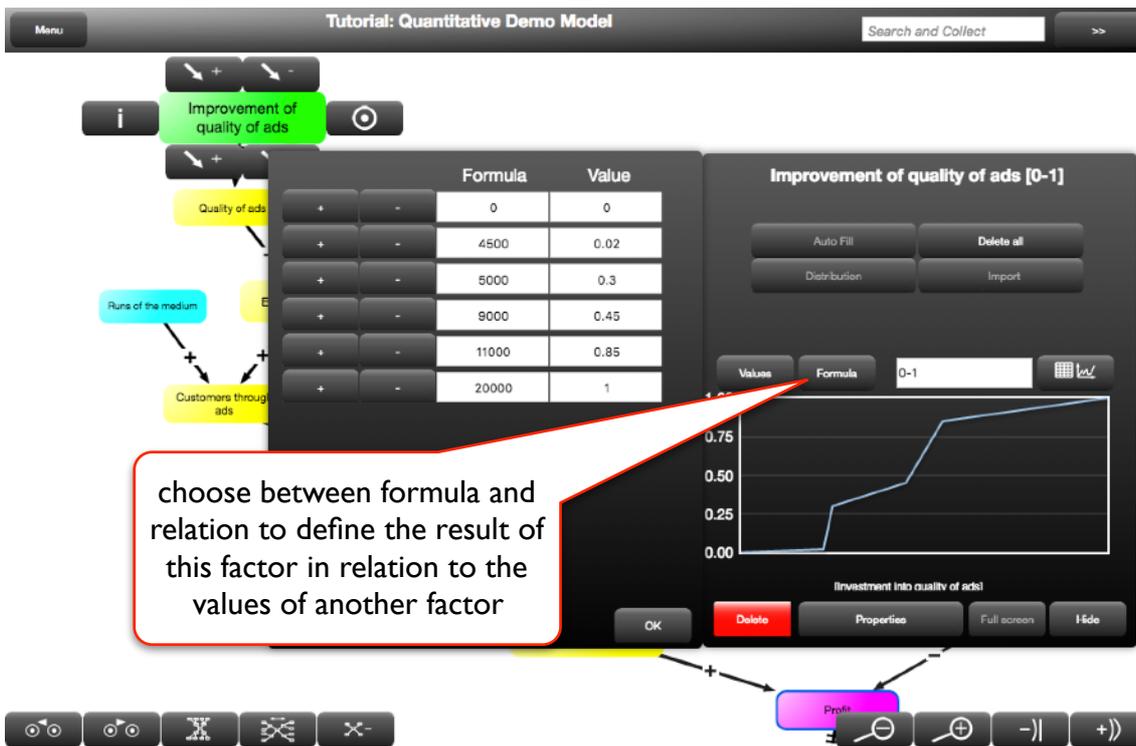
The first five functions from the list we call power functions that you can combine, e.g. if you need to use a stock function that should not become negative:



You can also define the unit for each factor (that will be shown for example as a header in tables) and the interpolator (per default it is "linear" which means that between two defined time steps the values will be added in a linear way).

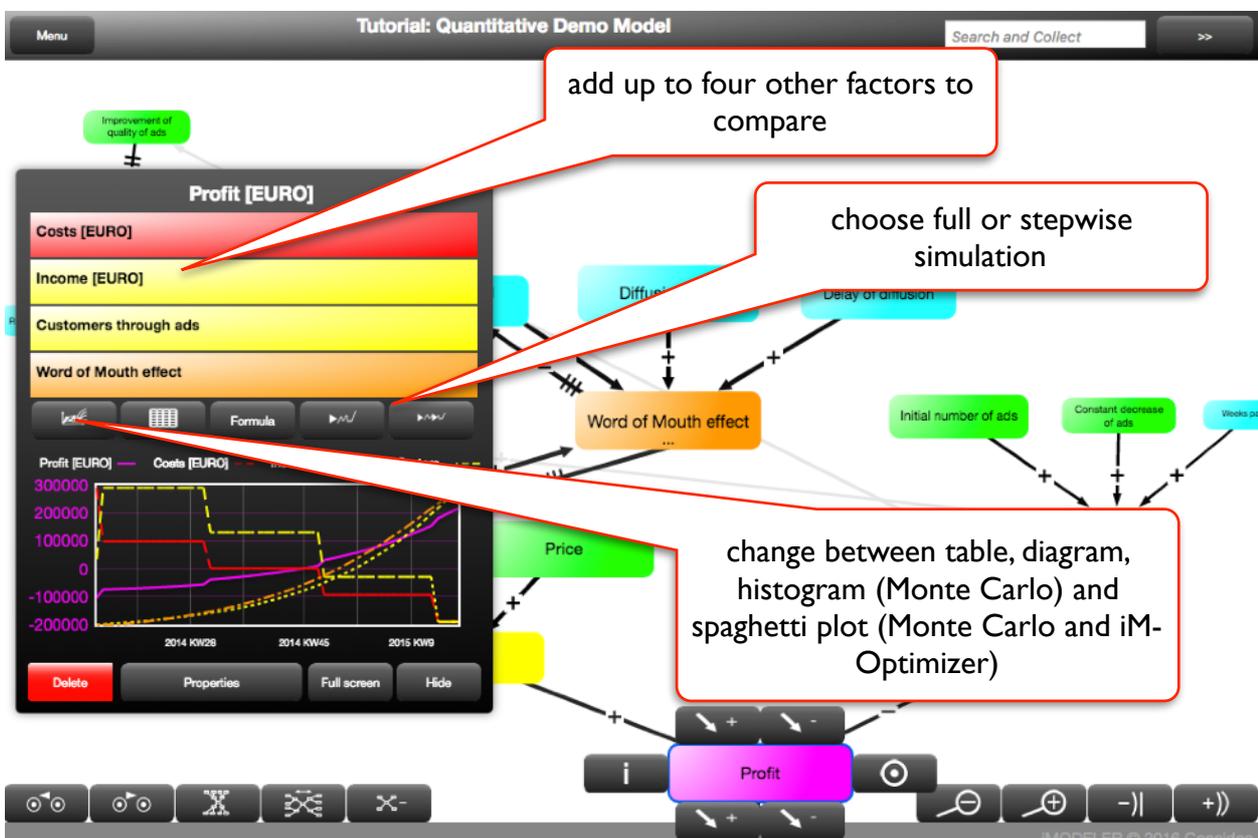
### 8.3. Relations

Relations can be used as a powerful alternative to sophisticated if() formulas. Connect for example a factor Income with a factor Price of Car and then simply say for the formula of Price of Car that it is (equal to) Income. After that you click on the Relation button where you can opt to show the values and define that between an income of 1500 and 5000 the price of a car is 15000, between 5001 and 10000 it is 30000 and so on. You simply put two different dimensions into a relation. (Note: If you leave the factor's properties showing the formula, the iMODELER takes the formula, if it shows the relation, the iMODELER takes the relation!)



### 8.4. Simulations

As shown in the screenshot above in Section 8.2, you can navigate from any factor to see the cockpit view. There you can run a full or stepwise simulation, opt to see the resulting curves or analyze using a table view, a miniature view or a full window view, and add or exchange up to four additional factors you want to compare.



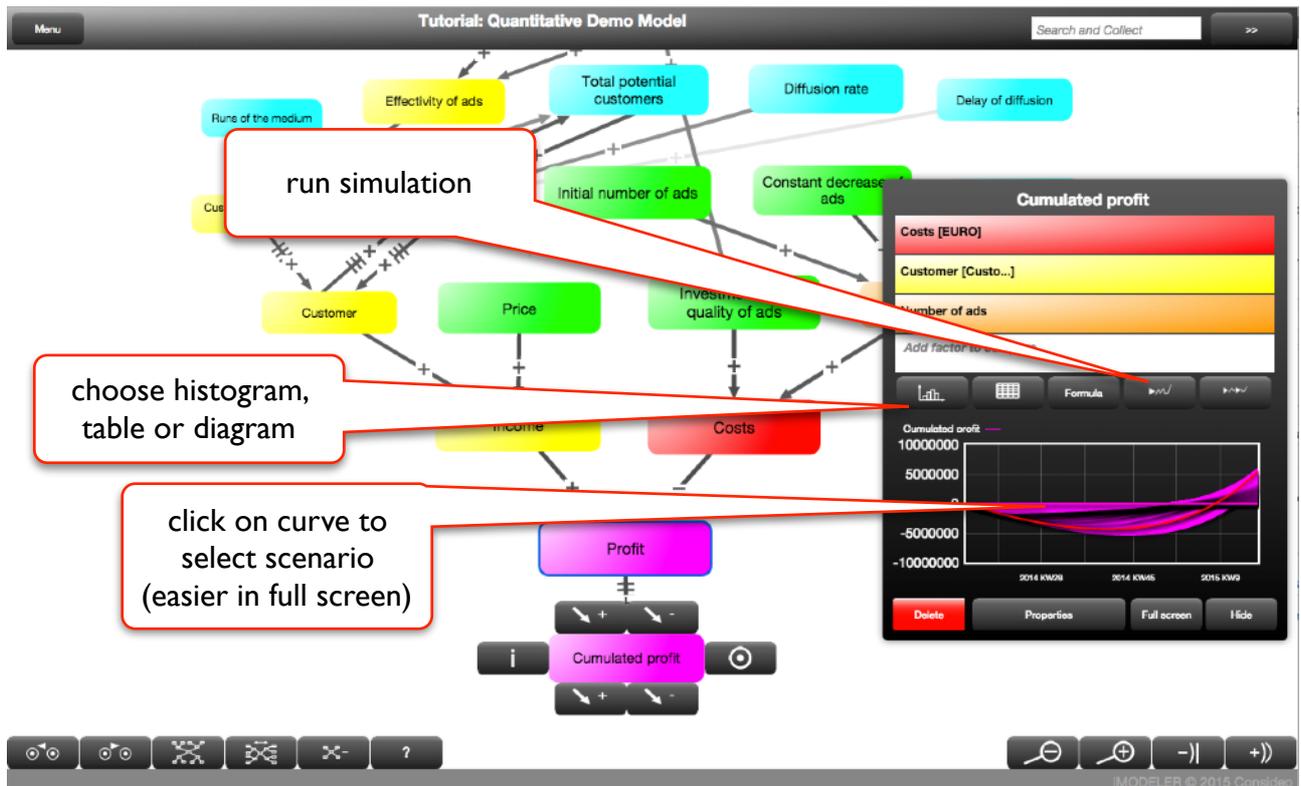
The miniature view allows you to simply click on other factors in the background and see their results.

## 9. Monte Carlo:

Everything that is possible?

Very important functions are `gaussrandom()`, `likelihood()` and `random()`. They allow you to simulate scenarios not just with fixed parameters but with a bandwidth of possible developments that might randomly happen. This way your scenarios become far more realistic.

Once you use one of the functions in your model the iMODELER asks you when starting the simulation how many runs of the Monte Carlo simulation you would like execute. The result then is a series of runs displayed in a so-called spaghetti plot in which you can select each individual run to see what values the other factors have within it.



The histogram, then, shows you the likelihoods of different values at a chosen time.



## 10. Range function and iM-Optimizer:

What could be the optimal solution?

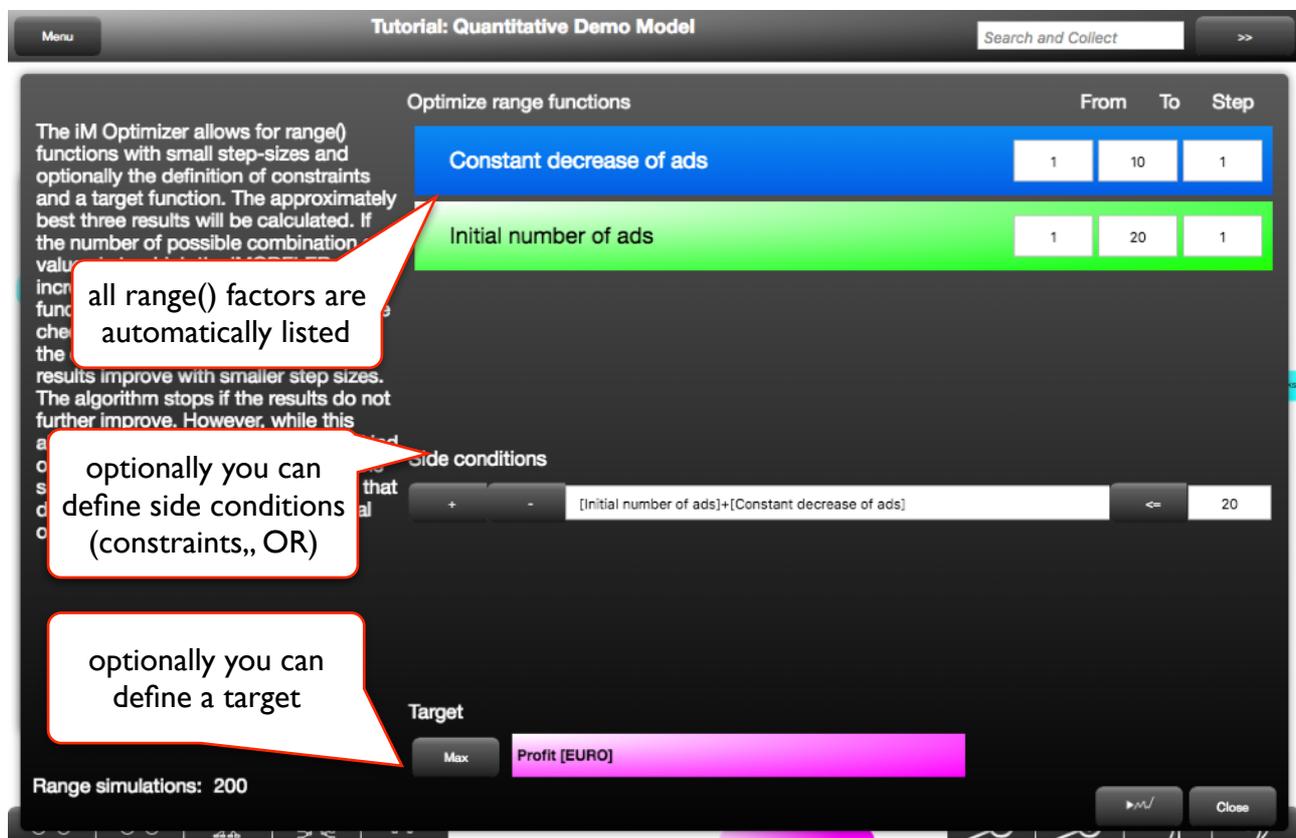
Using the range() function the iMODELER can run combinations of parameters so that, like with the Monte Carlo simulation, you can select different scenarios results to see what has led to them. For example, the factors Budget for marketing and Budget for Development can be given the same formula: range(10000 ; 20000 ; 100).. In this formula, 10000 is the start value, 20000 the end value, and all values in between at 100-unit intervals should be run in a scenario. In this way, we can analyze results to determine the ideal budget allocation within these parameters.

Therefore, this method allows you to identify the optimal set of parameters for a decision such as with Operations Research (OR), or the parameters to explain past behavior in order to forecast future behavior; similarly a potential use of regression analysis.

As the number of possible combinations that the iMODELER needs to calculate can quickly grow to millions, we offer with the iM-Optimizer - an algorithm that approximates the optimal result. Approximation, unfortunately, reduces certainty regarding the optimal result, but if used appropriately delivers plausible and insightful results.

The principle behind this algorithm is fairly easy. As long as the total number of possible combinations is considered too big for calculation, the step size of the range functions will be increased. If you have defined a target, the best three results will be taken as starting points (using the original step size) to determine if there are better results nearby. This process is then repeated until there are no better results found.

With side conditions you can set constraints on the processing. For example in the case that you have different options for expenditures within a budget, the sum of these needs to be below the total budget.



The screenshot shows the 'Optimize range functions' window in the iM-Optimizer. It features a table of range functions, a section for side conditions, and a target setting.

|                          | From | To | Step |
|--------------------------|------|----|------|
| Constant decrease of ads | 1    | 10 | 1    |
| Initial number of ads    | 1    | 20 | 1    |

Side conditions: [Initial number of ads]+[Constant decrease of ads] <= 20

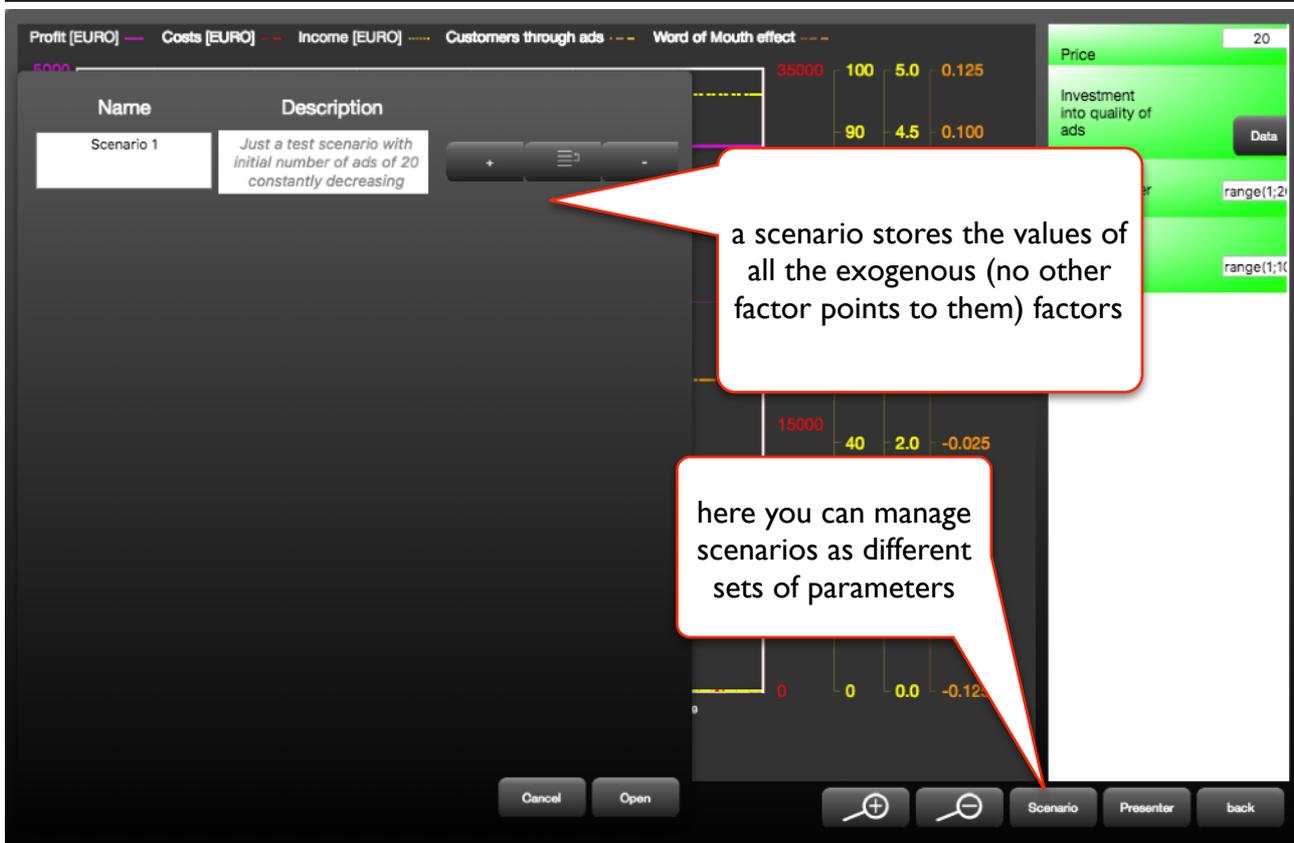
Target: Max Profit [EURO]

Range simulations: 200

Annotations:

- all range() factors are automatically listed
- optionally you can define side conditions (constraints,, OR)
- optionally you can define a target

## II. Scenarios: Save parameters and compare scenarios

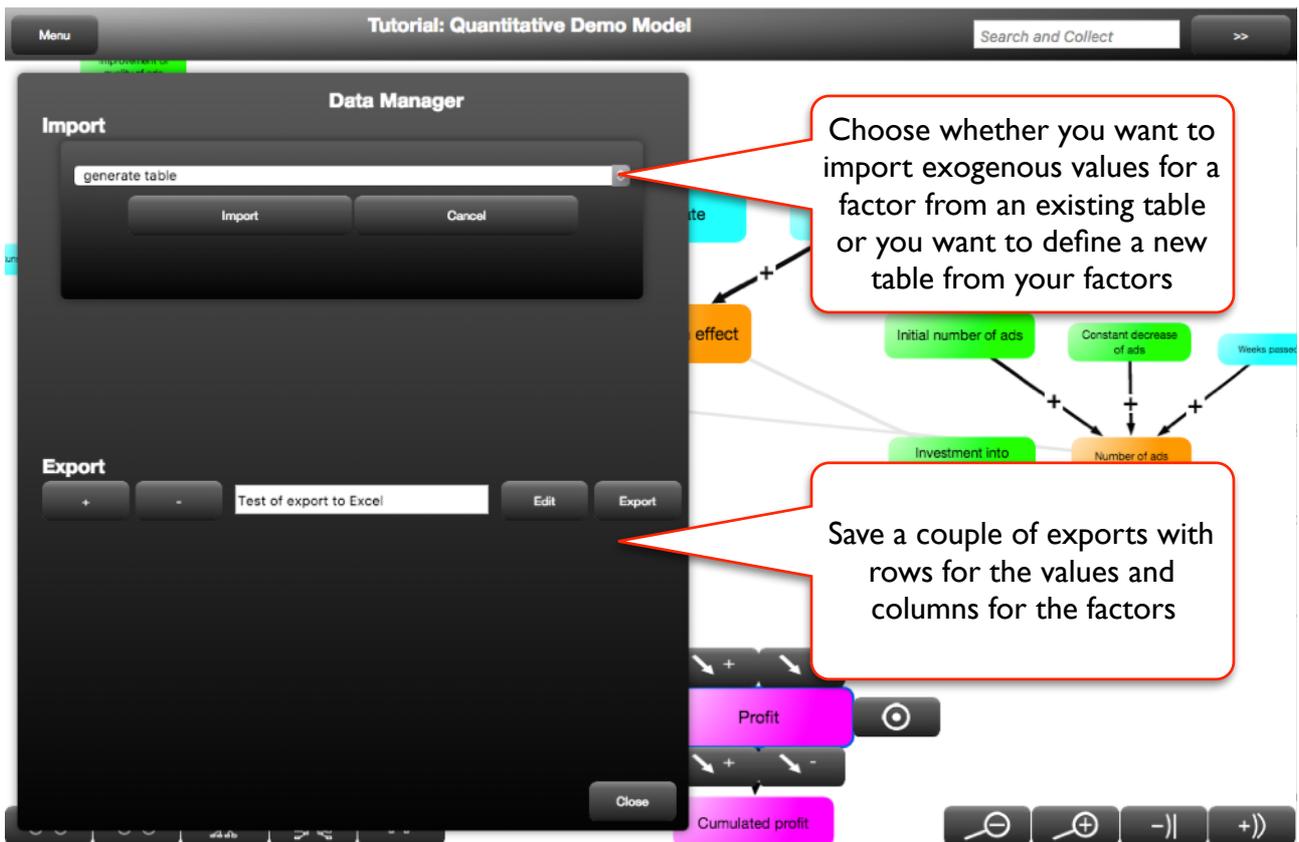


## 12. Import and export (with iM-Data Manager)

Each factor from a quantitative model as well as the Insight Matrix values from qualitative models can be exported to Excel or csv via the Export button in the cockpit. For exogenous factors (see 8.1) you can also import values from Excel or csv.

As these kinds of exports and imports are manually set for each factor, the iMODELER offers via Menu ... Data Manager a more convenient way for defining and altering them.

An extremely helpful feature is the possibility to generate a table from the exogenous factors of the model. Each column of the table will then already be connected to the factors so you can fill this table with data e.g. within Excel and then re-import it.



**Choose whether you want to import exogenous values for a factor from an existing table or you want to define a new table from your factors**

**Save a couple of exports with rows for the values and columns for the factors**

Of course, the location of the files and the naming of spreadsheets etc. need to remain the same in order to be used repeatedly. Note: this feature is currently inaccessible on mobile operating systems like iOS that cannot save files.

## 13. PROCESS-iMODELER Features

Projects and processes fail when we overlook crucial factors or underestimate their impact. Classic tools for projects and processes do not calculate the effects of so-called soft factors, often fail to include a very large number of factors, and cannot analyze the dynamics. Actually, most of them already fail when they attempt to calculate the possible outcome of parallel processes or project steps that depend on the same resources.

The PROCESS-iMODELER (PiM) allows you to visualize, quantitatively analyze and optimize even complex processes and projects. Special types of factors help to model processes and projects

without the need for sophisticated formulas. Example models for all kinds of challenges you will find on KNOW-WHY.NET .

For projects the task is to forecast the progressions of a project and its dynamics as close to reality as possible. For example, a change of specification, the absence of resources, parallel tasks or indeed any number of incidents with associated likelihoods of happening have effects which need to be understood. These factors cause different bottlenecks or constraints. Both, hard and soft factors can be put into relation, e.g. weather, communication, motivation. Some very prominent troubled projects like the construction of Berlin's new airport, creation of Boeing's Dreamliner airplane, the Energiewende, and countless others would have benefited from modeling.

The PiM answers questions like "when and with what likelihood can we finish the project with our available resources?" or "what true costs at what point in time will we face?" or "how many resources do we need to invest the get the project done by a specific deadline with a certain quality?" or "what consequences would certain disturbances regarding quality, formal requirements, etc. cause?". With these questions you are able to handle project costs, multi-project management, project risk management and project portfolio management.

For processes also hard and soft factors can be combined during simulation. You can determine with which likelihood what throughput at what point of time will be possible. As explained, you can also identify constraints (see E.Y. Goldratt's Theory of Constraints, ToC) following the critical chain principle. and optimize processes through both hard and soft operations research (OR).

The PROCESS-iMODELER features are unique in at least three ways:

- Processes and projects can be modeled in their true complexity.
- Special types of factors allow the modeling of processes, projects, resources, and milestones in their interactions more powerfully than classic system dynamics (SD) can.
- The modeling of processes and projects is much easier than with any other tool (that we know today). Even non-experts can simply click together their processes or projects while experts should also love some of the PROCESS-iMODELER's unique features.

### 13.1. Factor types for processes, projects, resources ...



Each factor can be defined (via its properties window) either as a “Normal factor” or as one of the following new PROCESS-iMODELER factor types:

- Process factors - describe process steps that depend on the availability of the resources that are connected to them, on the amount of already finished units at the end of the process step (accumulated in a so called Level-resource factor), on the set parameters that define how many resources (“Amount”) a unit takes, and how long (“Time”) it takes for this amount of resources to process one unit.
- Project factors - describe project steps that depend on the availability of the resources that are connected to them, on the accomplishment of the milestone at the end of the process step (accumulated in a so called Milestone factor that needs to reach the value of 1), on the set parameters that define how many resources (“Amount”) it takes to reach the milestone, and how long (“Time”) it takes for this amount of resources to reach the milestone (not the actual duration but the theoretical time).
- Resource factors - describe resources like machines, storage capacities, human resources, etc., all of which can be either used in a time step or remain unused.
- Level-resource factors - describe resources like material, intermediate products, orders etc. that can be accumulated by process factors and used by process or project factors. When they are not used, they can be used later. They are automatically inserted when you connect two process factors!
- Milestone factors - a project factor leads to a milestone. The project step then stops when the milestone reaches the value of 1. Unlike resource factors the following project factor does not take from the milestone but is only concerned with whether it is reached or not. They are automatically inserted when you connect two project factors!

Categories, shapes, colors

When you define a PiM factor it automatically gets a category with the same name. That allows you to easily filter your model for example to see only the process steps and also attach a symbol or choose a color for all the resources, processes, etc. in your model.

The iMODELER displays the rules for what can be connected with what and sometimes, as already mentioned, it automatically inserts a missing factor. You can combine process and project factors, for example if the preparation of a machine is the milestone you need in order to start a process or if a project needs to have a certain amount of level resources.

You may recognize that we do not use standard notations, UML or PBMN but rather a natural language. We simply want anyone to be able to model processes or projects without learning complicated standards. The experts will understand the natural language, too. Well, hopefully.

How to model a process?

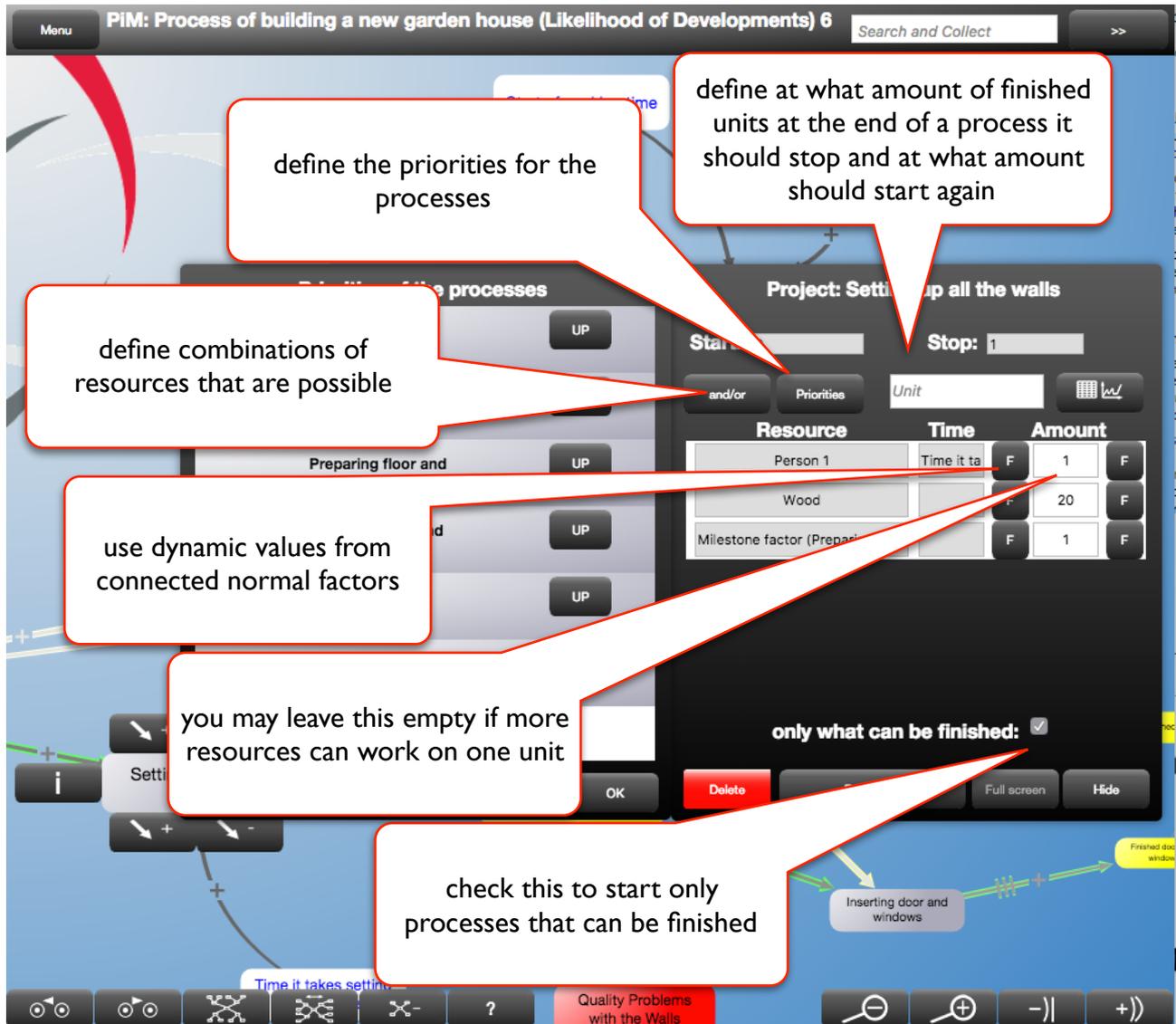
Process factors lead to level-resource factors.

Process factors have a start and a stop value. The process runs - provided the necessary resources are available - until the following level-resource factor reaches the stop value. After that it will restart to run again when the level-resource is lower than the stop value. This way you can define that you always want to keep certain stock of something prepared for the next process step.

When you click on the formula of a process factor you will find all connected resources and level-resources in a table view to define the time they are required to be used and amount of them needed in order to process one unit. Also you can define whether to start a process using parts of a needed resource or only start if wholes of the process can be finished with the “only what can be finished” checkmark. As an example, you could define that mounting car seats takes two workers four

minutes, one car and two seats. With just one seat the process would only start if you didn't check "only what can be finished".

Note: you may leave the 'Amount' field empty in order to define that, for example, it takes four minutes for one worker; two minutes for two workers, and one minute for four workers. However, if you define a value for 'Amount', two additional workers wouldn't be used for the same car. Without defining the amount it is just "working hours".



Via the and/or button you can open an editor to define combinations of resources. For example you may want to say that (resource 1 and resource 2) or (resource 3 and resource 4) can be used. The first (in this example resource 1 and resource 2) from the left will be checked first and if they are available the process step will use them. After that it will try the next combination (in this example resource 3 with resource 4) unless the stop criteria is reached.

From each process factor you can view a list of priorities of the process factors that share the same resources. This list shows from top down the order in which the processes look for available resources. Therefore if the stop value of a process step higher on the list is not yet reached, it will run at the amount that the least available resource allows. The next process from the list then sees what is left of the resources from the processes with higher priorities.

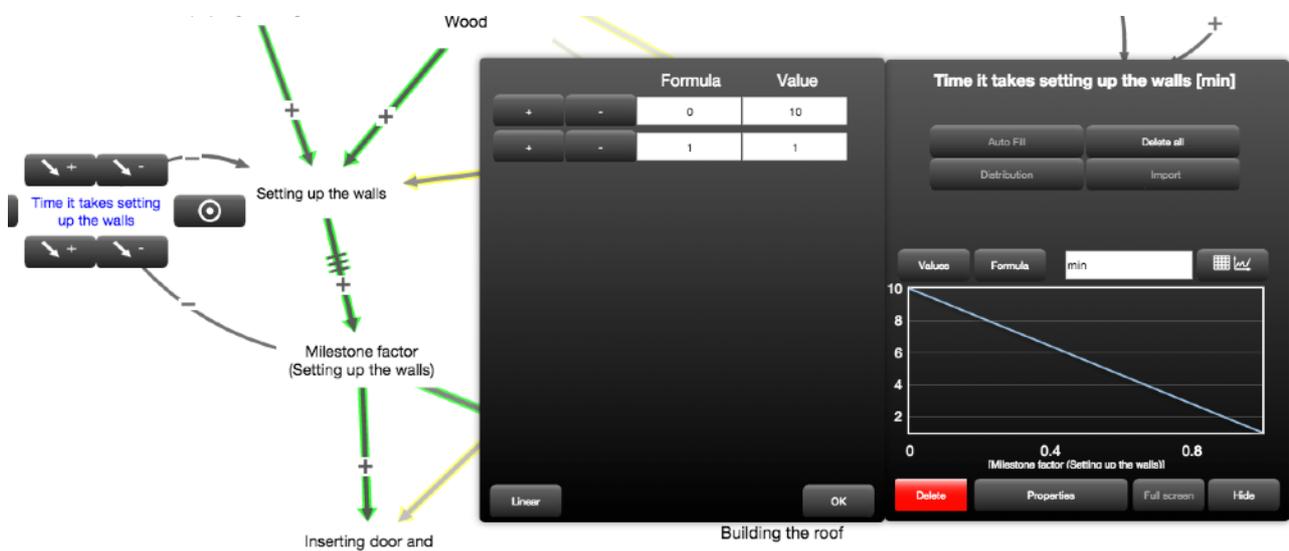
However, if a process with a lower priority has started with a unit it will have the chance (by being given a higher priority) in the next time step in order to finish the unit it has started.

With the UP buttons you can change the priorities. You may even select several processes to move them as a block.

With the Reverse button you can change the order of priorities for the whole list. This could be useful for example in order to change from a pull process that tries to process the last step as early as possible to a pull process that prioritizes the stocks (the stop values) along the process chain.

The "F" button next to each parameter allows you to choose a value from a connected normal factor instead of a fix value. The normal factor then can have a fix value that you can alter in the full-screen cockpits to try different scenarios. This value could be dependent for example on the already finished units (to describe a learning or exhaustion curve), or a random value (using gauss random and Monte Carlo simulations) to model a bandwidth of possible durations.

The following picture shows that the time it takes setting up the walls (in the process of building a house) decreases from 10 to 1 (using the iMODELER's relation editor) the closer the project step comes to reaching the milestone of 1. It basically shows a learning curve.



For each resource you can define the cost per unit. The cost of a process or a project can be calculated in two ways. Either you simply sum up in a normal factor the costs for each resource that is present and each level-resource that is used, or you sum the costs of the actual usage of resources by the processes in a normal factor by using a valuebefore(0) + costs(process)\* process formula.

You may also benefit from the UsedResourceForProcess values that are available when you connect a process to a normal factor. They represent the value of the resources that the process is using at each time step.

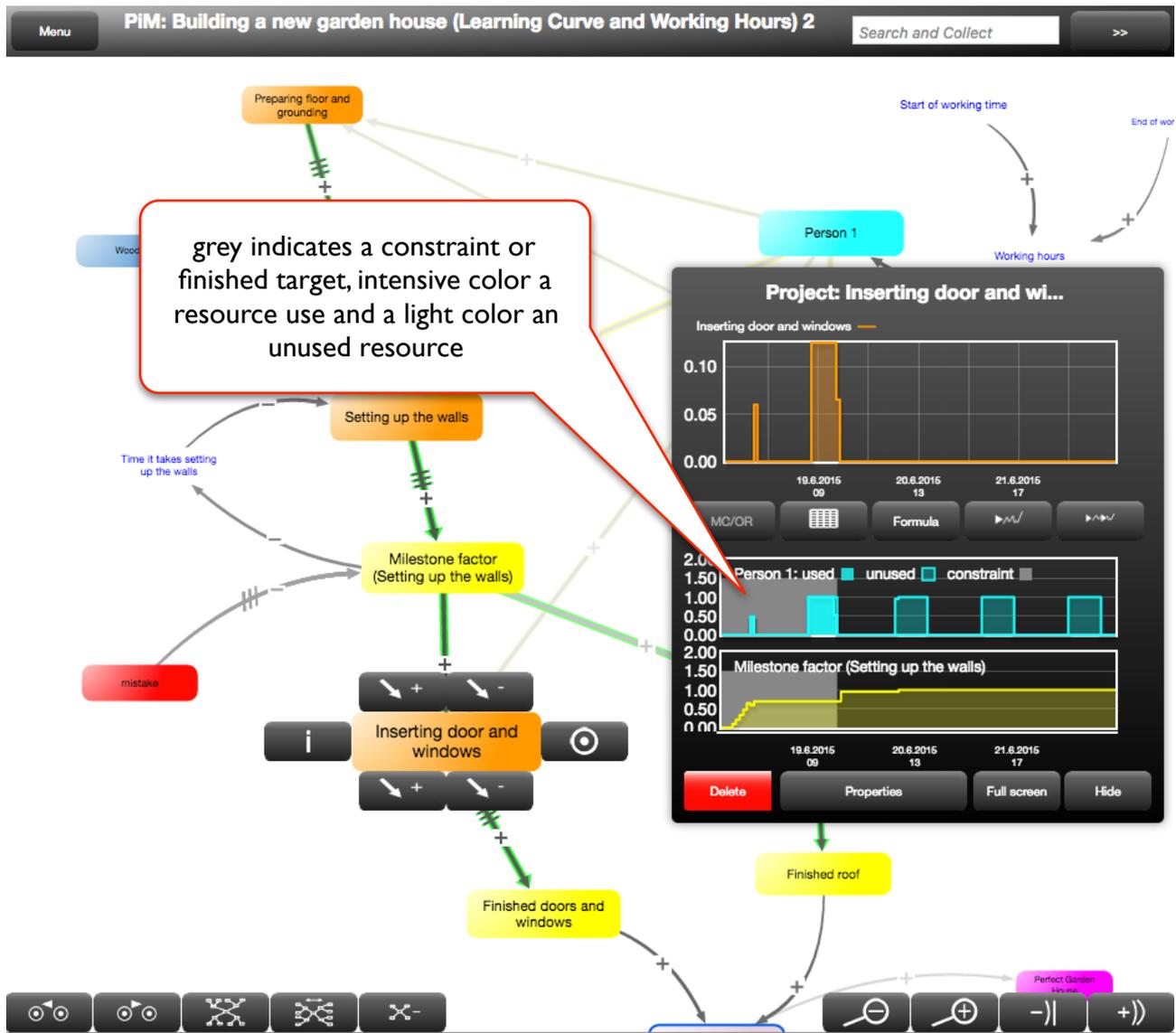
### 13.2. Identification of Constraints

To analyze processes and projects the PiM factors automatically show predefined useful cockpits.

A resource factor shows how much is used and remains unused by each of the processes.

A process or project factor shows the extent to which it is running, how much stands as a result, to what extent resources are used (intense color in the diagram) and what capacities the connected resources have left (less intense color in the diagram). This way you can easily see what resources are bottlenecks (constraints with grey background in the diagram or highlighted figures in the table view)

at a certain point in time, and which are not. These may even represent a waste of resources as they remain unused.

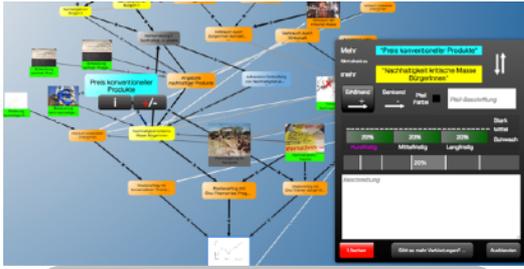


It should be noted that basically all the functionality described for process factors is also applicable for project factors except that they have no start and stop value and result in a milestone factor rather than level-resource factors.

If a project step for example says that 10 windows need to be installed then the milestone represents the completion of 10 windows. The parameter for the project step wouldn't define the time that one window takes, but the time all 10 windows should take.

#### 14. Simulation Games with the iMODELER

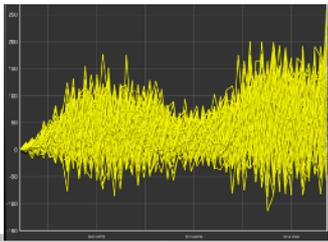
Take a challenge with several factors that others should not just passively look at but experience through a gaming situation



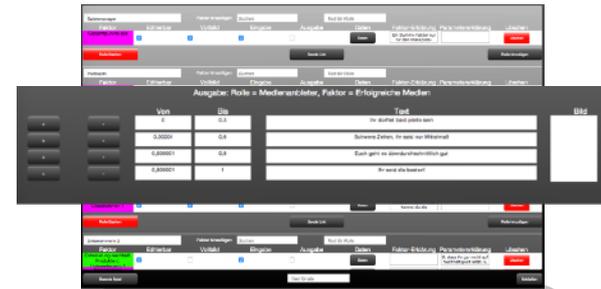
start with a qualitative cause and effect model that describes the situation



Quantify the model and define input factors for actors or incidents within the model that can be altered by the players of the game



Test the model through range() or Monte Carlo simulations



Define roles, their input factors, their output factors and the interface they should get to see.

| Zeit | Wirtschaft | Umwelt | Sozial | Technologie | Wirtschaft | Umwelt | Sozial | Technologie |
|------|------------|--------|--------|-------------|------------|--------|--------|-------------|
| 1    | 12,25      | 2,47   | 0,02   | 0,09        | 0,19       | 0,19   | 0,19   | 0,19        |
| 2    | 13,96      | 2,45   | 0,10   | 0,12        | 0,19       | 0,19   | 0,19   | 0,19        |
| 3    | 16,09      | 2,40   | 0,11   | 0,16        | 0,19       | 0,19   | 0,19   | 0,19        |
| 4    | 18,75      | 2,36   | 0,11   | 0,18        | 0,19       | 0,19   | 0,19   | 0,19        |
| 5    | 21,47      | 2,37   | 0,09   | 0,22        | 0,19       | 0,19   | 0,19   | 0,19        |
| 6    | 23,96      | 2,32   | 0,23   | 0,25        | 0,19       | 0,19   | 0,19   | 0,19        |
| 7    | 26,40      | 2,27   | 0,24   | 0,28        | 0,19       | 0,19   | 0,19   | 0,19        |
| 8    | 27,70      | 2,19   | 0,24   | 0,32        | 0,19       | 0,19   | 0,19   | 0,19        |
| 9    | 28,80      | 2,18   | 0,24   | 0,36        | 0,19       | 0,19   | 0,19   | 0,19        |
| 10   | 29,16      | 2,16   | 0,25   | 0,39        | 0,19       | 0,19   | 0,19   | 0,19        |
| 11   | 29,80      | 2,28   | 0,19   | 0,42        | 0,19       | 0,19   | 0,19   | 0,19        |
| 12   | 30,74      | 2,33   | 0,05   | 0,45        | 0,19       | 0,19   | 0,19   | 0,19        |
| 13   | 30,92      | 2,25   | 0,12   | 0,48        | 0,19       | 0,19   | 0,19   | 0,19        |
| 14   | 30,54      | 2,15   | 0,26   | 0,53        | 0,19       | 0,19   | 0,19   | 0,19        |
| 15   | 29,27      | 2,09   | 0,25   | 0,58        | 0,19       | 0,19   | 0,19   | 0,19        |
| 16   | 27,11      | 2,07   | 0,27   | 0,68        | 0,19       | 0,19   | 0,19   | 0,19        |
| 17   | 23,00      | 2,06   | 0,27   | 0,83        | 0,19       | 0,19   | 0,19   | 0,19        |
| 18   | 20,10      | 2,04   | 0,27   | 0,87        | 0,19       | 0,19   | 0,19   | 0,19        |
| 19   | 18,25      | 2,14   | 0,16   | 0,79        | 0,19       | 0,19   | 0,19   | 0,19        |
| 20   | 16,51      | 2,12   | 0,18   | 0,74        | 0,19       | 0,19   | 0,19   | 0,19        |
| 21   | 14,86      | 2,12   | 0,18   | 0,77        | 0,19       | 0,19   | 0,19   | 0,19        |
| 22   |            |        |        |             |            |        |        |             |
| 23   |            |        |        |             |            |        |        |             |
| 24   |            |        |        |             |            |        |        |             |
| 25   |            |        |        |             |            |        |        |             |
| 26   |            |        |        |             |            |        |        |             |
| 27   |            |        |        |             |            |        |        |             |
| 28   |            |        |        |             |            |        |        |             |
| 29   |            |        |        |             |            |        |        |             |
| 30   |            |        |        |             |            |        |        |             |

Define a factor where the game manager can run the simulation step by step and observe the game

Konventionelle Positionen d. Medien

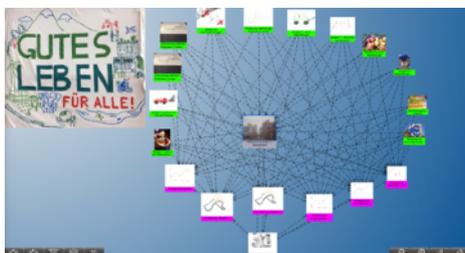
- Wir berichten hin und wieder über Öko-Themen, sofern sie bereits
- Wir berichten über die Gegenpositionen zu Öko-Themen, um uns
- Wir ignorieren die ökologischen Themen, da diese unsere Zielgrup

Nachhaltigkeits - Themen

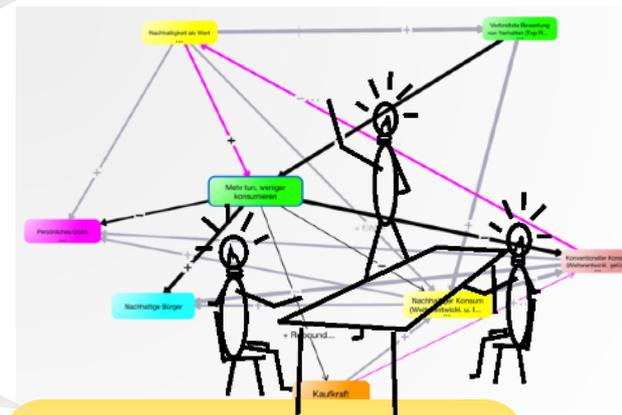
- Wir berichten regelmäßig über Folgen des Klimawandels und and
- Wir berichten regelmäßig über negative Beispiele aus Wirtschaft
- Wir berichten regelmäßig über alternative Lebensweisen und Unte

Herzlich Willkommen, Medienanbieterin, zum Planspiel "Eine Zukunft für alle"

Start the game, send the links to the roles (let individuals or even groups play a role. If necessary play a role by yourself).



Decide how many rounds you want to play, whether you want to export the results and when to reveal and explain the model behind the game.



Let the players develop their own qualitative (with the freeware) models.

## 14.1. Defining roles

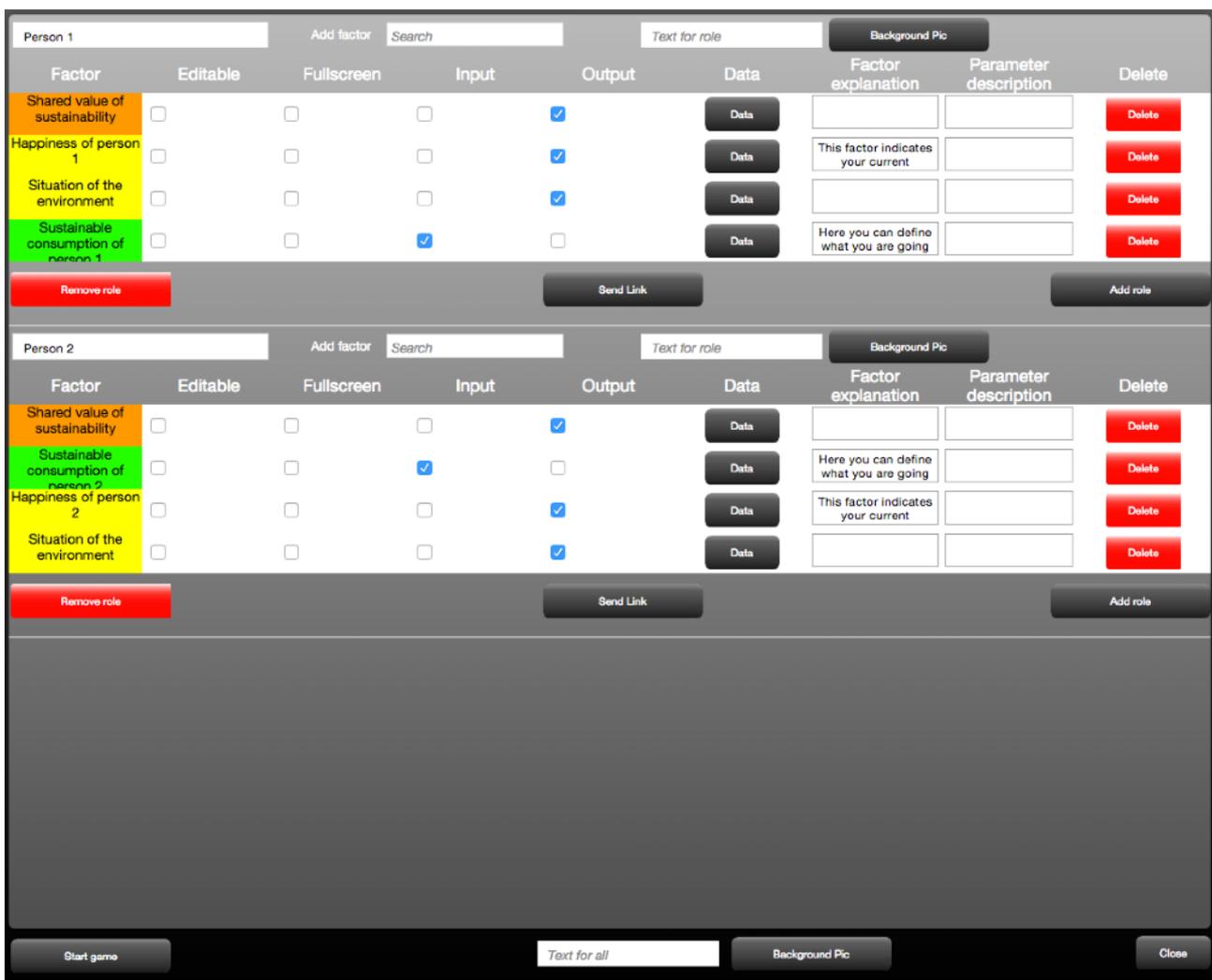
First there is the qualitative model:

Link: <https://www.know-why.net/model/CuXNVoXVKGy8FwsxIVzMNpQ>

You can explore the model to see the formulas and test of the model e.g. by looking at its presenter entry. To manipulate the game or to create your own you first have to activate the simulation game management option (Menu ... preferences) and then choose it from the menu.

Here you see just the key interfaces:

Define Roles:



The screenshot displays two identical role configuration panels, one for 'Person 1' and one for 'Person 2'. Each panel features a table with columns for Factor, Editable, Fullscreen, Input, Output, Data, Factor explanation, Parameter description, and Delete. Below the table are buttons for 'Remove role', 'Send Link', and 'Add role'.

| Factor                              | Editable                 | Fullscreen               | Input                               | Output                              | Data | Factor explanation                     | Parameter description | Delete |
|-------------------------------------|--------------------------|--------------------------|-------------------------------------|-------------------------------------|------|--|-----------------------|--------|
| Shared value of sustainability      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Data |  |                       | Delete |
| Happiness of person 1               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Data | This factor indicates your current     |                       | Delete |
| Situation of the environment        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Data |  |                       | Delete |
| Sustainable consumption of person 1 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Data | Here you can define what you are going |                       | Delete |

| Factor                              | Editable                 | Fullscreen               | Input                               | Output                              | Data | Factor explanation                     | Parameter description | Delete |
|-------------------------------------|--------------------------|--------------------------|-------------------------------------|-------------------------------------|------|--|-----------------------|--------|
| Shared value of sustainability      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Data |  |                       | Delete |
| Sustainable consumption of person 2 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Data | Here you can define what you are going |                       | Delete |
| Happiness of person 2               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Data | This factor indicates your current     |                       | Delete |
| Situation of the environment        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Data |  |                       | Delete |

At the bottom of the interface, there are buttons for 'Start game', 'Text for all', 'Background Pic', and 'Close'.

Click on data to define the input options they have:

Input: Role = Person 2, Factor = Sustainable consumption of person 2

| Text                     |  | Value | Picture   |
|--------------------------|--|-------|---|
| <input type="checkbox"/> | You don't use a car anymore - instead you use public transportation, your bicycle or opt to travel significantly less. | 0.2   |  |
| <input type="checkbox"/> | You don't eat meat, fish, milk or other animal products  | 0.2   |  |
| <input type="checkbox"/> | You wear only organic clothes  | 0.1   |  |
| <input type="checkbox"/> | You invest into insulation and alternative heating technologies  | 0.3   |  |
| <input type="checkbox"/> | You actively support environmental initiatives   | 0.2   |  |

Multiple choice:

Close

Click on data to define the output descriptions they can see:

Output: Role = Person 2, Factor = Shared value of sustainability

| From   | To | Text   | Picture   |
|--------|----|--|---|
| 0      | 1  | it seems people do not value your sustainable behavior                       |  |
| 1.0001 | 5  | together with your community you push each other towards more sustainability |  |
| 5.0001 | 10 | you and the community are changing the world to a better                     |  |

Show current value:

MOOBLE © 2015 Consideo

Define your simulation manager's cockpit to control the game:

| Time | Target | Shared value of sustainability | Happiness of person 1 | Happiness of person 2 | Situation of the environment |
|------|--------|--------------------------------|-----------------------|-----------------------|------------------------------|
| 1    | 0.00   | 0.78                           | 6.67                  | 7.16                  | 0.88                         |
| 2    | 14.71  | 0.53                           | 2.80                  | 5.28                  | 0.76                         |
| 3    | 23.56  | 0.37                           | 1.56                  | 3.34                  | 0.66                         |
| 4    | 29.11  | 0.39                           | 3.81                  | 1.54                  | 0.69                         |
| 5    | 35.14  | 0.46                           | 2.36                  | 4.00                  | 0.70                         |
| 6    | 42.21  | 0.06                           | 0.18                  | 0.12                  | 0.25                         |
| 7    |        |                                |                       |                       |                              |
| 8    |        |                                |                       |                       |                              |
| 9    |        |                                |                       |                       |                              |
| 10   |        |                                |                       |                       |                              |

Sustainable consumption of person 1 0.3

Sustainable consumption of person 2 0.2

Load
▶/⏪
▶/⏩
MOOR
Export
Scenario
Presenter
back

## 14.2. Playing the game

Here is the input for one of the players:

About
Time step: 1

### Sustainable consumption of person 2 [0-1]

Here you can define what you are going to choose to do the sustainable way. .

- 

You don't use a car anymore - instead you use public transportation, your bicycle or opt to travel significantly less.
- 

You don't eat meat, fish, milk or other animal products
- 

You wear only organic clothes
- 

You invest into insulation and alternative heating technologies
- 

You actively support environmental initiatives



Show model
Go
Results

Here is the output of one of the players:



There is much more to say about simulation games with the iMODELER:

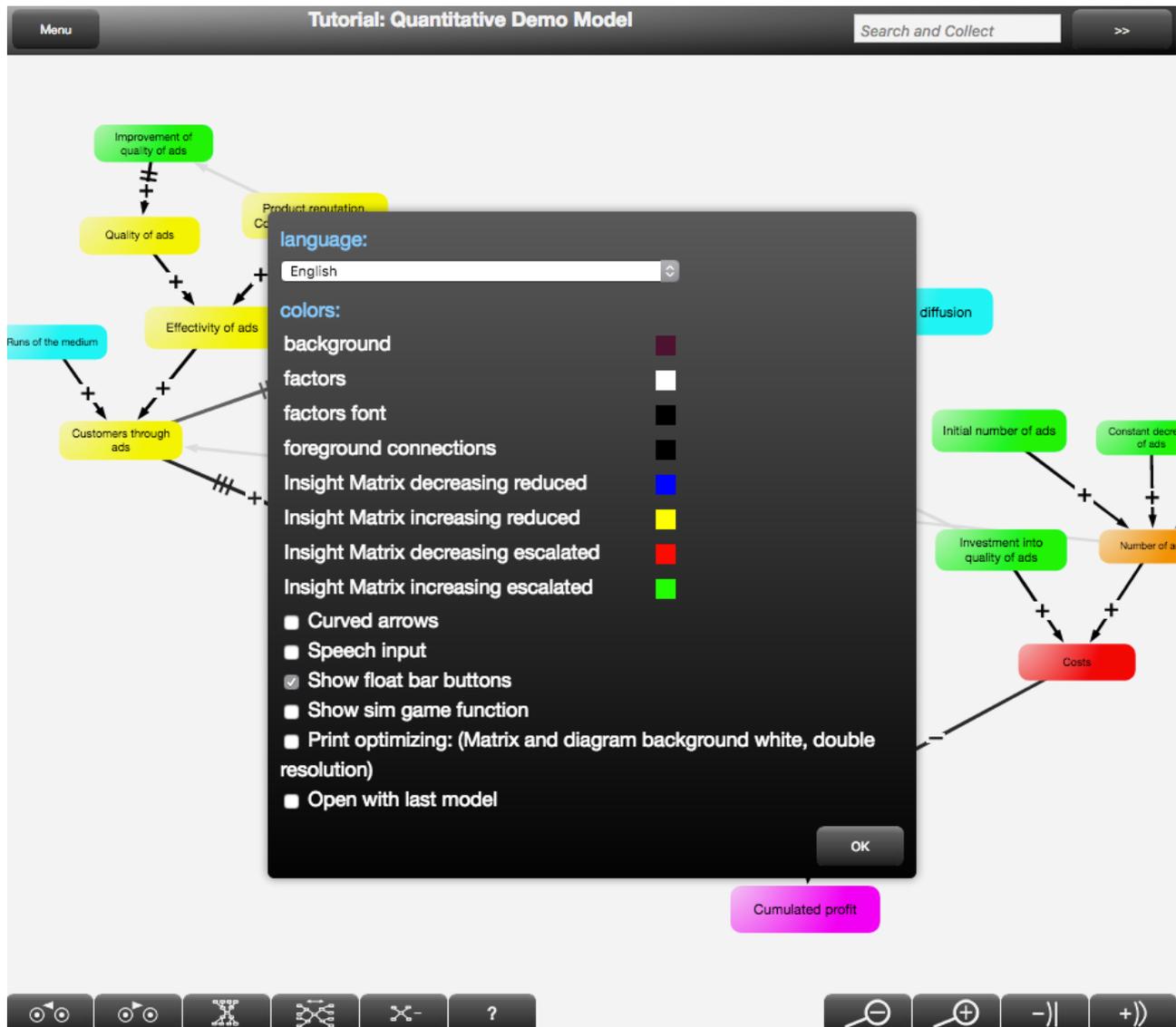
- their purpose is to motivate people to understand interconnections of a concrete challenge
- they should be fun, so use nice texts and pictures, keep the game short, and consider allowing communication between the players
- plan for enough time to discuss the model and if possible let the players start their own model

## 15. Further settings in the iMODELER

Via Menu ... Preferences you can set a couple of parameters. Curved Arrows will, you guessed it, show curved instead of straight arrows. This setting is stored with the model.

Speech Input works with Google Chrome and shows microphones on the buttons where you can speak text instead of typing it.

Print optimizing sets the dark backgrounds from diagrams and matrices to white and asks when you export screenshots (Menu ... Export View) whether you want to increase the resolution/quality of the graphic.



The screenshot shows the iMODELER interface with a preferences dialog box open. The dialog box is titled "Tutorial: Quantitative Demo Model" and contains the following settings:

- language:** English
- colors:**
  - background: dark purple
  - factors: white
  - factors font: black
  - foreground connections: black
  - Insight Matrix decreasing reduced: blue
  - Insight Matrix increasing reduced: yellow
  - Insight Matrix decreasing escalated: red
  - Insight Matrix increasing escalated: green
- Curved arrows
- Speech input
- Show float bar buttons
- Show sim game function
- Print optimizing: (Matrix and diagram background white, double resolution)
- Open with last model

The background shows a causal loop diagram with nodes such as "Improvement of quality of ads", "Quality of ads", "Effectivity of ads", "Customers through ads", "Initial number of ads", "Investment into quality of ads", "Number of ads", "Costs", and "Cumulated profit".

## 16. Conclusion: Importance of modeling and upcoming features

We know of no other tool that simply translates arguments with no further need to learn a modeling notation or follow specific rules. The ability to analyze the consequences from the sum of arguments through the Insight Matrix is unique, as is being able to navigate through extremely large models mirroring the way our brain works. This makes the iMODELER an incredibly important tool for reflecting on anything that needs you to consider the interplay of several factors (indeed, almost everything)! You should use it for your own thoughts, within meetings, workshops, projects, your company, even for discussions with your partners and families.

The features on quantitative modeling though based on the well-known system dynamics approach can directly quantify qualitative models with no need to use special types of factors.

Our mission is to let people reflect on interconnections in order to come up with intelligent solutions to make the world a better place. Therefore we provide both the freeware and the professional solution. And we work in schools to teach modeling early on.

The road map for iMODELER is fascinating. Next to a new look, performance improvements and much more, there are soon to come features like the iM-Document Manager, the iM-Virtual Meeting Room and something more which cannot yet reveal.

## 17. App 1: KNOW-WHY Thinking

The KNOW-WHY Method and its four questions that help you to systematically build your model are actually systemic questions in order to ask for universal drivers of anything. Behind this is KNOW-WHY Thinking, an approach that seeks to identify whether things are both integrating and developing in order to be successful. If something lacks integration or development it is in jeopardy. You can use the four questions without being aware of KNOW-WHY Thinking. It simply works. If you are interested in a bit of systems thinking background you should have a look at our books (even an interactive ebook on Apple's iBooks Store) and papers on KNOW-WHY Thinking.

## 18. App 2: Cause and effect modeling as a scientific method

While the methodology of the quantitative approach is simply system dynamics, the approach of the qualitative modeling is unique to iMODELER with no further scientific reference. It is inspired by cross impact analysis and Fuzzy Cognitive Maps (FCM) and yet more advanced.

What is more important, however, is the question of whether you can model only empirically backed data in the sense of inductive logic (not as some mistakenly assume deductive logic) or whether you work with assumptions in the sense of abductive logic, like is done with Qualitative Social Research or Grounded Theory.

While there is an ongoing dispute over this question in the scientific community as well as in philosophy the answer is actually obvious: if there are empirical data you should use it until you find better empirical data. However, if there are no data because the phenomenon you are exploring is rather unique or set in the future under unique conditions you have to work with assumptions. And you have to make clear that you use assumptions and you should consider varying them in order to see alternative outcomes (sensitivity analyses). Whether the model is right or wrong depends on the assumptions you make (more of .... leads directly to more/less of ...) and on the crucial factors you include (e.g. using the KNOW-WHY questions).

## 19. App 3: The mathematical functions of the iMODELER

The first five functions are so-called power functions that you can select simultaneously or add to an existing formula afterwards.

### Stock (Power-Function)

Sums up like a stock known from system dynamics. The inflows and outflows come with a delay of one time step (as defined in system dynamics).

### Relative\_quantification (Power-Function)

Sums up incoming connections with their weighting from a previous qualitative modeling.

### Multiplicative (Power-Function)

The product of all incoming values.

### Additive (Power-Function)

The sum of all incoming values.

### Non\_Negative (Power-Function)

Adds to an existing formula  $\max(0; \dots)$  in order to prevent negative values.

### abs

Returns the absolute value of a number or formula.

$\text{abs}(-3.2)$  becomes  $+3.2$

### acc

Sums up the values from a factor:  $\text{acc}([\text{Factor1}] + [\text{Factor2}])$  returns the same as  $\text{valuebefore}(0) + [\text{Factor1}] + [\text{Factor2}]$ .

### and

Is used for if()-formula.

$\text{if}([\text{Factor1}] \geq 1 \text{ and } [\text{Factor1}] \leq 5; 12; 4)$  returns 12, if Factor 1 has a value between 1 and 5, else 4

### arctan

Arc tangent

### average

...

condense

Returns sum for certain periods of time.

condense(months()); [Factor]) for example sums up for the time unit days the sum of the current month. They have to stand at the end of a cause chain.

cos

Cosine

costs

Calculates the costs of a connected PROCESS-iMODELER factor as the sum of the costs of its connected resources.

date

if(time()==date(23.10.2011); 12; 0)

day

The day of the current time step

if(day()==8;0;1)

dayofweek

See day()

decade

See day()

delay

A powerful function to define fixed or variable delays.

delay0([Verzögerung]; [Input])

exp

exp(1) returns 2,718281....

gaussrandom

Is used for a Gauss distribution with Monte Carlo simulations.

gaussrandom(10; 2) returns values around 10 with a sigma of 2.

halfyear

See day()

hour

See day()

if

if([Factor 1]>= 5; if([Factor 1]<=10;12;0)2)

int

int(2.8) returns 2

likelihood

Returns with the likelihood given in percentage 1 else 0. It can be used to initiate Monte Carlo simulations. likelihood(80)

log10

...

logn

...

max

max(2;13;5) returns 13 (of course you can use factors)

mean

mean(2;6;4) returns the mean value of 4 (of course you can use factors)

min

....

minute

Returns the minute of the current time step

month

...

not

...

or

...

pi

3,14159625

pow

pow(2; 3) returns  $2 * 2 * 2$

quarter

...

random

Randomly outputs a number between 0 and 1, for example to be used for a Monte Carlo simulation

range()

See the iM-Optimizer (Section 10)

round

round(5.6) returns 6, (of course you can use factors)

sqrt

sqrt(9) returns 3 (of course you can use factors)

second

...

sumtotal

Sums values between two points of time

tan

...

time

Returns the current timestep

valuebefore

valuebefore(5) remembers the value this factor had in the previous time step. The value in brackets defines the start value for the first time step. It is used to build stocks as they are used in system dynamics

week

See day()

year

See day()

If you need any addition functions please let us know :-)

## 20. App 4: Short keys

|                  |  |
|------------------|--|
| L:               | show loops                                       |
| P:               | show presenter                                   |
| I:               | show properties                                  |
| SHIFT+I:         | show model properties                            |
| C:               | change perspective to selected factor            |
| D, Back, Delete: | delete   |
| M:               | Insight Matrix                                   |
| CTRL+DOWN:       | zoom smaller                                     |
| CTRL+UP:         | zoom bigger                                      |
| CTRL+0:          | No Zoom 100%                                     |
| alt + up         | zoom in (Desktop Version)                        |
| alt + down       | zoom out (Desktop Version)                       |
| alt + 0          | zoom reset (Desktop Version)                     |
| ESC:             | ESC  |
| K:               | search on KNOW-WHY.NET                           |
| N:               | new model  |
| O:               | open model manager                               |
| SHIFT+S:         | share dialogue                                   |
| S:               | search factor                                    |
| CTRL+LEFT:       | go to previous perspective                       |
| CTRL+RIGHT:      | go to next perspective                           |
| Space:           | change the number of shown levels of connections |
| Shift + Space    | change number of shown perspective back          |

|            |   |
|------------|---|
| +:         | new, increasing factor to the currently selected factor |
| -:         | new, decreasing factor ...                              |
| 2:         | less fisheye  |
| 3:         | more fisheye  |
| ,:         | go to previous perspective                              |
| .:         | go to next perspective                                  |
| F:         | show filter/cluster dialogue                            |
| Shift + P: | show presenter  |
| Z:         | undo  |
| Shift + Z: | redo  |

## 21. App 4: Tips and Tricks and Literature

How to model processes and projects?

How to compare solutions?

How to develop strategies?

Idealized System Design to come up with revolutionary solutions.

The HIDP to plan for personal success and happiness.

These and more can be found in our books and through example models on [KNOW-WHY.NET](http://KNOW-WHY.NET)