

Get Started with Visual PROMETHEE

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Introduction



Get Started with Visual PROMETHEE 1.5

April 23, 2015

This document is designed to give you the basics for starting to use **Visual PROMETHEE**. You can find much more complete information in the **Visual PROMETHEE 1.5** Manual and Help file available for download at www.promethee-gaia.net.

This content is regularly updated. Check the www.promethee-gaia.net web site for the latest version.

This document is organized in three sections:

[Introduction](#) (*this section*)

- [What is it about](#)
- [What is Visual PROMETHEE?](#)

Tutorial

A step-by-step tour of **Visual PROMETHEE** using simple examples.

- [The main window](#)
- [A guided tour](#)
- [Working with multiple scenarios](#)
- [Starting a new problem](#)

How to enter and analyze your own decision or evaluation problem

Guidelines on how to model your own decision problem and analyze it with **Visual PROMETHEE**.

- [Define a new problem](#)
 - [Define the actions](#)
 - [Define the criteria](#)
 - [Define the scenarios](#)
 - [Model preferences](#)
 - [Organize the criteria](#)
 - [Weigh the criteria](#)
- [Rank different actions](#)
- [Use the GAIA analysis](#)
- [Perform a sensitivity analysis](#)
- [Use weight presets](#)
- [Generate a report](#)

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What is it about

Visual PROMETHEE is a multicriteria decision aid ([MCDA](#)) software.

It is designed to help you to:

- Evaluate several possible decisions or items according to multiple often conflicting criteria.
- Identify the best possible decision.
- Rank possible decisions from the best to the worst one.
- Sort items into predefined classes such as for instance: bad customers, good customers, exceptional customers.
- Visualize decision or evaluation problems to better understand the difficulties in making good decisions.
- Achieve consensus decisions when several decision-makers have conflicting points of view.
- Justify or invalidate decisions based on objective elements.

Here are some **examples** of fields of application and of how **Visual PROMETHEE** can help you:

- **Purchase of an equipment:**

Q: Which equipment is best? The cheapest? The most reliable one? The most technology advanced one? Or more probably a good compromise between price, quality and performance?

A: Define your [criteria](#) (cost, reliability, performance, look, ...). They can be quantitative (\$, kg, mph, ...) or qualitative (reliability, quality, design, ...). Model your preference (scales, thresholds, ...) and priorities ([weigh](#) the criteria). The **PROMETHEE rankings** will then show you what is (are) the best possible choice(s).

- **Procurement - Evaluation of suppliers:**

Q: Who is your best supplier for a type of product or service?

A: The best supplier should provide you with a best quality level at a most reasonable price. Price is thus one criterion that has to be confronted to quality. And quality should be evaluated on multiple criteria (quality of the products, quality of maintenance, respect of delivery terms, ...). The **PROMETHEE rankings** will show you who are the best suppliers. And the [GAIA](#) analysis can help you to negotiate better terms with your suppliers.

- **Definition of Key Performance Indicators (KPI):**

Q: How to evaluate performance of units (shops, logistic centers, teams, departments, ...) ?

A: **Visual PROMETHEE** allows for combining several indicators into a single performance score. The [Performance Analysis](#) module makes it possible to perform an Input/Output analysis and to obtain efficiency measurements.

- **Human resources management:**

Q: How to evaluate collaborators? How to select the best candidate for a job?

A: **PROMETHEE rankings** can help you identify the best candidate for a job or promotion. The [GAIA](#) analysis can be used to identify typical collaborators profiles, to identify personal weaknesses and to elaborate training programs.

- **Evaluation of projects:**

Q: How to manage a portfolio of e.g. R&D projects taking into account the expected return as well as the risk level and budget constraints?

A: The **PROMETHEE rankings** allow to evaluate different projects according to multiple criteria including return as well as risk. The [PROMETHEE V](#) selection method can then be used to elaborate a complete portfolio taking into account additional constraints such as budget limits, sectoral or geographical diversification, size, etc.

- **Investment selection:**

Q: What is the best investment solution or the best portfolio of investments taking into account return

and risk?

A: Here again the **PROMETHEE rankings** and the **PROMETHEE V** method can help you to find best balanced solutions suited to your preferences and priorities.

- **Location problems:**

Q: Where to build a new plant, a warehouse or a shop?

A: Different possible locations can be compared on many criteria such as for instance: investment cost, surface available, distance to customers, distance to suppliers, availability of transportation networks, environmental or social impacts, ... Use the **PROMETHEE rankings** to identify the best compromise solution(s).

- **Quality assessment:**

Q: How to evaluate the quality of products, of services, of procedures, of units?

A: **Visual PROMETHEE** allows you to define multiple evaluation criteria and to generate global quality scores (using the **PROMETHEE II net flow Phi**). The **GAIA** analysis and the **GAIA Webs** make it possible to make a full quality diagnosis.

- **Health care:**

Q: What is the best therapeutic choice?

A: Many health care decision problems are also multicriteria problems and can be handled by **Visual PROMETHEE**.

- **Environmental impacts and sustainable development:**

Q: How to make decisions in the context of sustainable development?

A: **Visual PROMETHEE** allows you to structure the criteria into clusters (for instance economical, environmental and social criteria) and groups (for instance air, water and soil impacts within the environmental criteria) of criteria. This makes it easier to perform **sensitivity** and what-if analyses. For instance giving more weight to the environmental criteria or less to the social ones is done very easily and the corresponding results are directly available with tools like the **Walking Weights** and the **Visual Stability Intervals**.

- **Negotiation and group decision making:**

Q: How to conciliate different and often conflicting points of view and to achieve a good consensus decision?

A: **GDSS PROMETHEE** provides extensions of the **PROMETHEE** and **GAIA** methods to the case where multiple decision makers are involved in the decision process. The multi-scenarios model enables to compare points of view, to pinpoint the sources of conflict and engage in a dynamic to solve the conflicts and to identify the best consensus decision(s).

Visual PROMETHEE is based on the **PROMETHEE** and **GAIA** methods that have been developed at the **ULB** and **VUB** universities of Brussels and have been widely used worldwide in many different decision or evaluation problems.

A detailed explanation of **MCDA** and the **PROMETHEE** and **GAIA** methods is available in the software manual.

What are PROMETHEE and GAIA

The [PROMETHEE](#) and [GAIA](#) methods are among the most widely used multicriteria decision aid methods.

PROMETHEE stands for **P**reference **R**anking **O**rganization **M**ETHOD for the **E**nrichment of **E**valuations.

GAIA stands for **G**raphical **A**nalysis for **I**nteractive **A**id.

The **PROMETHEE I** and **II** ranking methods were first developed by Professor Jean-Pierre Brans in 1982. Two years later Jean-Pierre Brans and Bertrand Mareschal developed **PROMETHEE III** (ranking based on intervals) and **PROMETHEE IV** (continuous decision problems). These two variants are not implemented. In 1988 **GAIA** was introduced which is a graphical complement to the PROMETHEE rankings. In 1992 **PROMETHEE V** was proposed as a solution for multiple selection under constraints. And in 1994 **PROMETHEE VI** (the "Decision-Maker Brain") was implemented in the **PromCalc** software.

In 30 years, several hundreds of scientific papers related to **PROMETHEE** and **GAIA** have been published in scientific journals all around the world. You can check the on-line Bibliographical Database at <http://biblio.promethee-gaia.net>. As of June 2015 more than 980 references are available.

Many organizations (private companies, public administrations, research centers, universities, individuals, ...) worldwide have been using **PROMETHEE**-based software for their decision-making or evaluation problems in various fields such as: banking, location of facilities, human resources management, water resources, investment, medicine and health care, chemistry, procurement, environmental problems, planning, project management, ...

If you want to discuss the potential of **Visual PROMETHEE** for your own decision or evaluation problems, please contact Bertrand Mareschal at bmaresc@ulb.ac.be.

Tutorial

After you have installed **Visual PROMETHEE** on your computer, a **Visual PROMETHEE** icon will appear on the desktop.

Double-click the  icon to start **Visual PROMETHEE**.

The tutorial is organized in five sections in the following order:

- [The main window](#)
- [A guided tour](#)
- [Working with multiple scenarios](#)
- [Advanced features](#)
- [Starting a new problem](#)

The main window

When you start **Visual PROMETHEE** the main window is displayed.

	Price	Power	Consumption	Habitability	Comfort
Unit	k€	kW	L/100km	5-point	5-point
Cluster/Group	●	◆	●	■	■
Preferences					
Min/Max	min	max	min	max	max
Weight	1,00	1,00	1,00	1,00	1,00
Preference Fn.	V-shape	Linear	V-shape	Level	Level
Thresholds	absolute	absolute	absolute	absolute	absolute
- Q: Indifference	n/a	5	n/a	1,0	0,5
- P: Preference	€ 15,000	30	2,0	2,5	2,5
- S: Gaussian	n/a	n/a	n/a	n/a	n/a
Statistics					
Minimum	€ 15,000	50	7,0	1,0	1,0
Maximum	€ 38,000	110	9,0	5,0	5,0
Average	€ 28,083	83	8,2	3,2	3,0
Standard Dev.	€ 7,407	18	0,7	1,3	1,3
Evaluations					
<input checked="" type="checkbox"/> Tourism B	€ 25,500	85	7,0	good	average
<input checked="" type="checkbox"/> Luxury 1	€ 38,000	90	8,5	good	very good
<input checked="" type="checkbox"/> Tourism A	€ 26,000	75	8,0	average	average
<input checked="" type="checkbox"/> Luxury 2	€ 35,000	85	9,0	very good	good
<input checked="" type="checkbox"/> Economic	€ 15,000	50	7,5	bad	very bad
<input checked="" type="checkbox"/> Sport	€ 29,000	110	9,0	very bad	bad

All Bertrand

Actions: 6 (6 active) Criteria: 5 (5 active) Scenarios: 1 (1 active) Locale: Belgium [€/,] Saved

The main window is organized as follows, from top to bottom:

- The [Main Menu](#) is displayed on the top of the window.
- There are two [Toolbars](#) with important commands:
 - Data management on the upper row.
 - Analysis management on the lower row.
- The main part of the window is the spreadsheet:
 - Most data are displayed and can be edited from the spreadsheet.
 - On the top section are the current scenario name ("Bertrand" in the above screen shot) and the criteria names together with check boxes for activating/deactivating the criteria and unit and

- cluster/group information. Click on the buttons to access [scenario](#) or [criterion](#) dialogs.
- The spreadsheet contains three collapsible sections: Preferences, Statistics and Evaluations. Click on the small icons in the leftmost column to collapse/expand these sections.
 - Preferences: For each criterion, the following data are available:
 - Min/max: select whether the criterion has to be minimized or maximized.
 - Weight: enter the weight of the criterion (weights are automatically normalized by the software).
 - Preference Fn.: select the preference function type (or select "Help me" to use the [Preference Function Assistant](#)).
 - Thresholds: select either "absolute" (thresholds expressed on the criterion scale of measurement) or "percentage" (thresholds expressed as percentages).
 - Q: Indifference: Indifference threshold.
 - P: Preference: Preference threshold.
 - S: Gaussian: Gaussian threshold.
 - Statistics: For each criterion, the following statistics are computed from the active actions: minimum and maximum values, arithmetic average and standard deviation.
 - Evaluations: There is one row for each action. The check box is used to control the activation/deactivation of the action. Click on the name button to open the [action](#) dialog. The shape identifies the action's category. Evaluations can be entered in different ways:
 - For quantitative criteria, enter the numerical value.
 - For qualitative scales, a drop-down list allows to choose the evaluation.
 - [Missing values](#) are allowed: enter "?" for a missing value. "n/a" (not available) stands for missing values.
 - At the bottom of the spreadsheet are tabs:
 - For each scenario, there is a tab. Click on the tab to switch to that scenario.
 - The "All" tab switches to the multi-scenarios analysis.
 - The bottom of the main window displays a status bar with some general information related to the current problem (dimensions, locale and save status). The status bar is clickable.

A guided tour

When starting **Visual PROMETHEE** a demo dataset is automatically loaded.

The screenshot shows the Visual PROMETHEE software interface. The main window displays a table with the following data:

	Price	Power	Consumption	Habitability	Comfort
Unit	k€	kW	L/100km	5-point	5-point
Cluster/Group	●	◆	●	■	■
Preferences					
Min/Max	min	max	min	max	max
Weight	1,00	1,00	1,00	1,00	1,00
Preference Fn.	V-shape	Linear	V-shape	Level	Level
Thresholds	absolute	absolute	absolute	absolute	absolute
- Q: Indifference	n/a	5	n/a	1,0	0,5
- P: Preference	€ 15,000	30	2,0	2,5	2,5
- S: Gaussian	n/a	n/a	n/a	n/a	n/a
Statistics					
Minimum	€ 15,000	50	7,0	1,0	1,0
Maximum	€ 38,000	110	9,0	5,0	5,0
Average	€ 28,083	83	8,2	3,2	3,0
Standard Dev.	€ 7,407	18	0,7	1,3	1,3
Evaluations					
<input checked="" type="checkbox"/> Tourism B	€ 25,500	85	7,0	good	average
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<input checked="" type="checkbox"/> Luxury 2	€ 35,000	85	9,0	very good	good
<input checked="" type="checkbox"/> Economic	€ 15,000	50	7,5	bad	very bad
<input checked="" type="checkbox"/> Sport	€ 29,000	110	9,0	very bad	bad

At the bottom of the interface, the status bar shows: Actions: 6 (6 active) | Criteria: 5 (5 active) | Scenarios: 1 (1 active) | Locale: Belgium [€/ ,] | Saved

The demo dataset is about the purchase of a new car. This problem has been used as an example in many **PROMETHEE** presentations (check the resources section at <http://www.promethee-gaia.net> to download presentations) and it was also provided as a tutorial with the **Decision Lab** software. So previous users should be familiar with it.

Let us suppose that somebody (the [decision-maker](#)) wants to purchase a new car and hesitates between six possible models (the [actions](#)):

- Two cars that we name **Tourism A** and **Tourism B**. These are classical family sedans.
- A more economical car that we name **Economic**.
- Two more luxury cars: **Luxury 1** and **Luxury 2**.

- And a more powerful car that we call **Sport**.

The names are chosen on purpose to reflect the characteristics of each car and to make it easier to understand how **PROMETHEE** and **GAIA** can help the decision-maker. In actual decision problems, the characteristics of the actions are usually much less obvious at first sight and **PROMETHEE** and **GAIA** will help you to discover these.

We suppose that the decision-maker has identified five [criteria](#) as important for choosing his/her new car:

- **Price**: That is the price of the car, expressed in Euros (€). Obviously the decision-maker prefers a lower price so this criterion should be minimized.
- **Power**: That is the power of the car, expressed in kW. This criterion should be maximized as more power is preferable.
- **Consumption**: Gas efficiency is measured the European way: it is the number of liters of gas consumed per hundred kilometers. It has thus to be minimized.
- **Habitability**: The perception of space is subjective and this criterion calls for a qualitative scale. Here we use the classical 5-point scale: very bad, bad, average, good and very good.
- **Comfort**: The comfort of each car is evaluated on the same 5-point scale (very bad to very good).

As you see Visual PROMETHEE can handle quantitative as well as [qualitative](#) criteria.

There is a column for each criterion and a row for each action (at the bottom of the spreadsheet).

The **Preferences** section contains information about the preferences of the decision-maker:

- **Min/max**: indicates whether the criterion should be minimized or maximized.
- **Weight**: the weight of a criterion is a measure of how much it is important with respect to the other criteria. In the demo all the weights are equal so that the five criteria are considered to be equally important. The weights can be adjusted according to the priorities of the [decision-maker](#), to the position of the [GAIA](#) decision axis or to the results of a [sensitivity analysis](#).
- **Preference Fn.**: Here you can see what type of [preference function](#) has been associated to each criterion.
- **Thresholds**: Absolute thresholds have been selected for all the criteria. The corresponding thresholds are thus expressed on each criterion's scale.
 - Q: Indifference threshold.
 - P: Preference threshold.
 - S: Gaussian threshold.

The **Statistics** section displays some basic statistics for the criteria:

- **Minimum**: for instance the cheapest car has a price of 15,000 €.
- **Maximum**: the most expensive car has a price of 38,000 €.
- **Average**: the average price (over all active actions) is equal to 28,083 €.
- **Standard Dev.**: the standard deviation of the prices of the active actions is equal to 7,407 €.

For each criterion, the best value is displayed in green and the worst one in red: for instance the **Economic** car is the cheapest one while the **Luxury 1** is the most expensive.

Actions, criteria and scenarios (in this dataset there is only one [scenario](#) named **Bertrand**) names are actually buttons that you can click to open the corresponding [Actions](#), [Criteria](#) and [Scenarios](#) dialogs in order to display and edit specific data.

The check boxes on the top row and in the leftmost column of the spreadsheet allow to control which criteria and/or actions are active. If you un-check one box, the corresponding criterion or action will be removed from the analysis. It is thus very easy to make what-if analysis and to see the impact of one action or criterion on the results of the analysis.

The colored symbols (circles, squares or diamonds) associated to the actions and the criteria correspond to the defined action [categories](#) and to the criteria [hierarchy](#).

Let us now start the analysis of the data.

- [Have a look at the PROMETHEE rankings.](#)
- [Learn to use the GAIA plane.](#)
- [Make a sensitivity analysis.](#)

The PROMETHEE rankings

There are two **PROMETHEE** rankings that are computed:

- The **PROMETHEE I** Partial Ranking is based on the computation of two [preference flows](#) (Phi+ and Phi-). It allows for incomparability between actions when both Phi+ and Phi- preference flows give conflicting rankings.
- The **PROMETHEE II** Complete Ranking is based on the net [preference flow](#) (Phi).

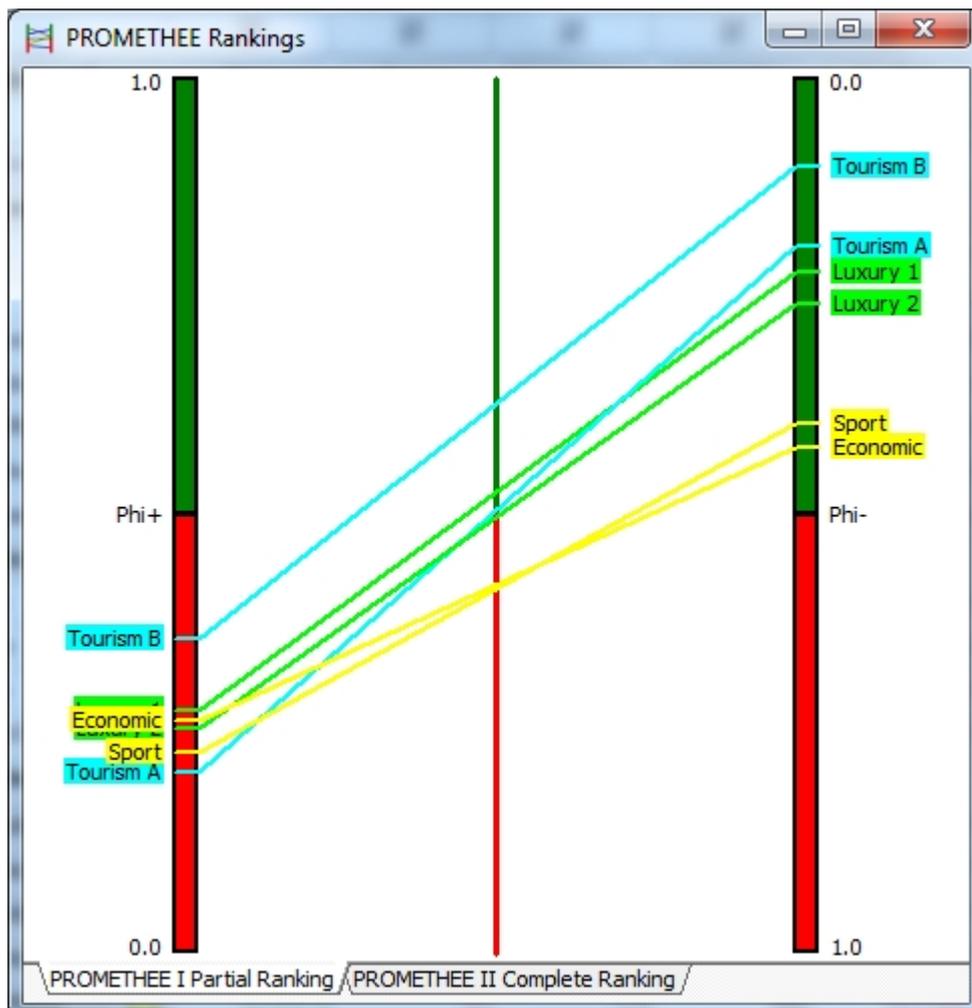
Visual PROMETHEE offers several ways to display the **PROMETHEE** rankings.

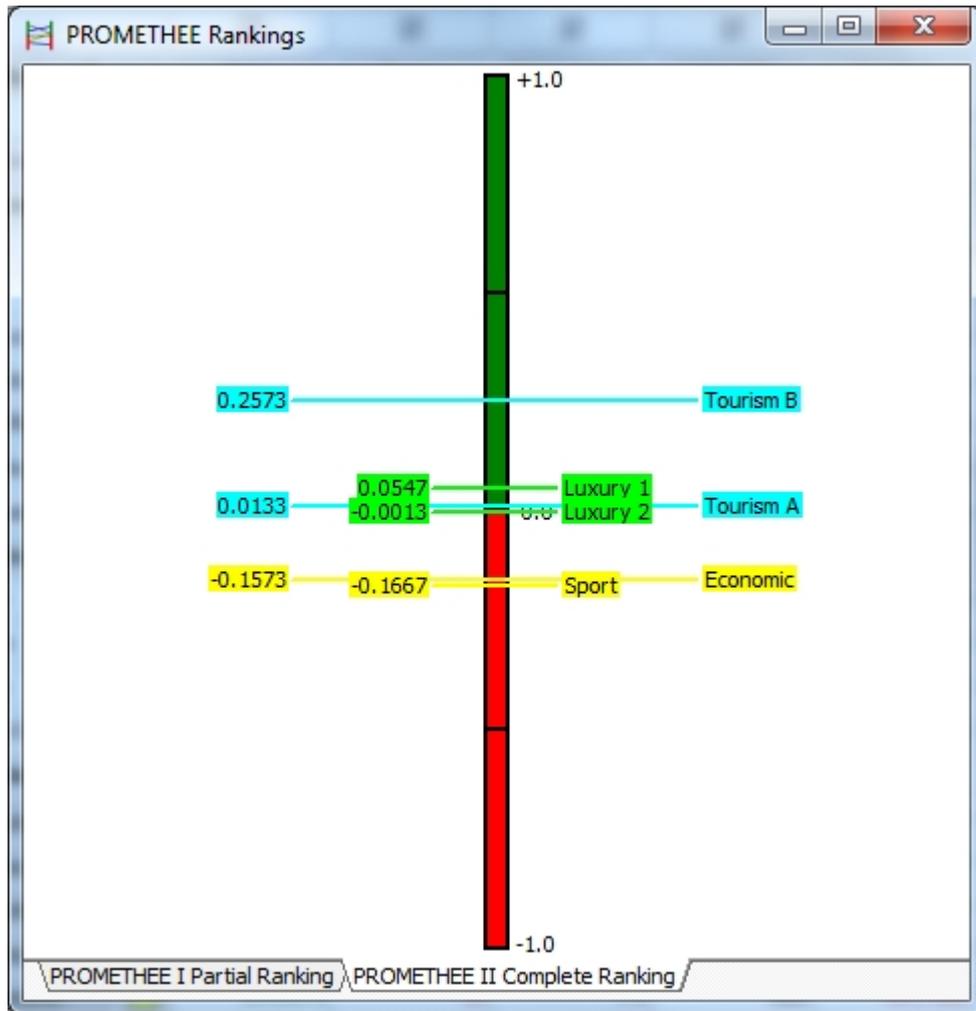
PROMETHEE Rankings

Click "**PROMETHEE-GAIA | PROMETHEE Rankings**" to open this window.

The [PROMETHEE Rankings](#) window has two tabs that can be selected at the bottom of the window:

- **PROMETHEE I** Partial Ranking
- **PROMETHEE II** Complete Ranking





On the **PROMETHEE I** Partial Ranking tab (left figure), the leftmost bar shows the ranking of the actions according to Φ^+ : **Tourism B** is on top, followed by **Luxury 1**, **Economic**, **Luxury 2**, **Sport** and **Tourism A**. The rightmost bar shows the ranking according to Φ^- : **Tourism B** is still on top, but it is followed by **Tourism A**, **Luxury 1**, **Luxury 2**, **Sport** and **Economic**.

We can conclude that:

- **Tourism B** is preferred to all the other actions in the **PROMETHEE I** ranking.
- **Luxury 1** is on top of **Luxury 2** but they are very close to each other.
- **Tourism A** is incomparable with the **Luxury** cars because it has a worse score on Φ^+ and a better one on Φ^- .
- **Sport** and **Economic** are also incomparable with each other but they are lagging with respect to the other ones. Indeed even if their Φ^+ score are similar to the previous cars, their Φ^- scores are well behind.

This is confirmed by the **PROMETHEE II** complete ranking (right figure). Three groups of actions appear clearly:

- **Tourism B** has a higher Φ score.
- **Luxury 1**, **Tourism A** and **Luxury 2** have lower scores and are all very close to zero. They are more average actions.
- **Economic** and **Sport** have also very close but negative scores. They are at the bottom of the **PROMETHEE II** ranking.

While the **PROMETHEE II** complete ranking is easier to explain it is also less informative as the differences

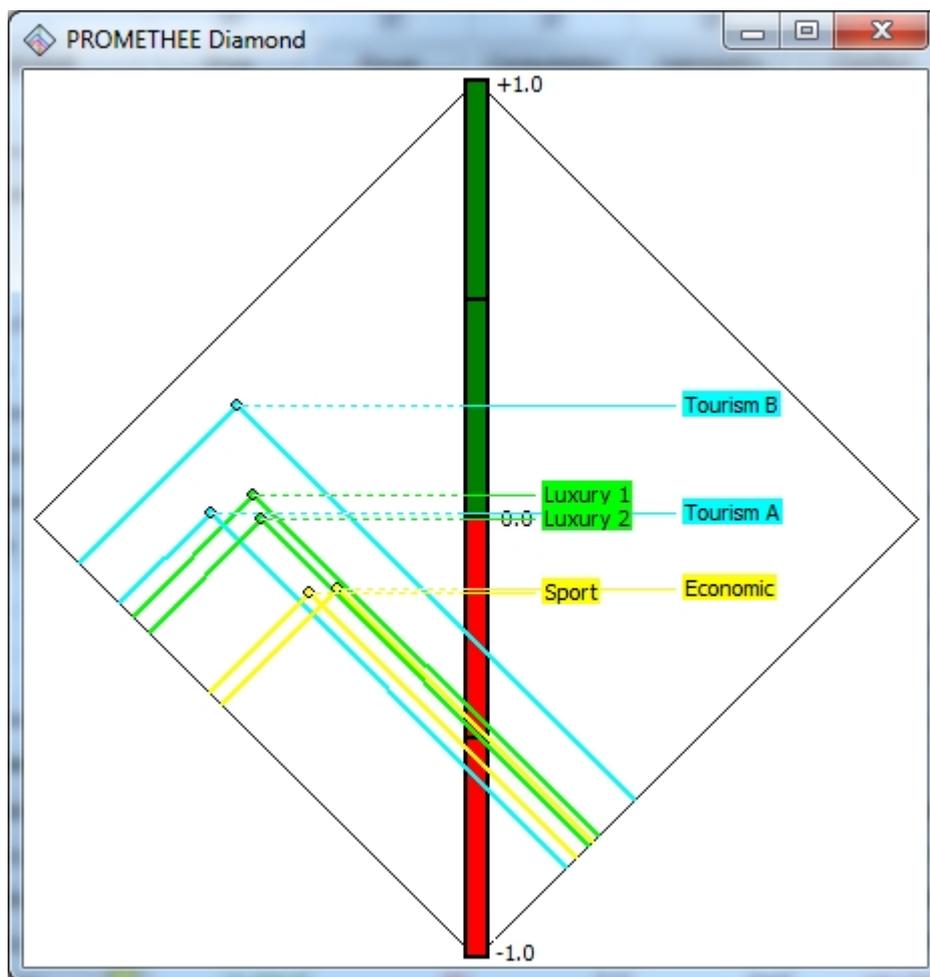
between Phi+ and Phi- scores are not visible anymore. Incomparability in the **PROMETHEE I** ranking is interesting because it emphasizes actions that are difficult to compare and thus helps the decision-maker to focus on these difficult cases.

PROMETHEE Diamond

Click **PROMETHEE-GAIA | PROMETHEE Diamond** to open this window.

The **PROMETHEE Diamond** is an alternative two-dimensional joint representation of both **PROMETHEE I** and **II** rankings.

The square corresponds to the (Phi+,Phi-) plane where each action is represented by a point. The plane is angled 45° so that the vertical dimension gives the Phi net flow. Phi+ scores increase from the left to the top corner and Phi- scores increase from the left to the bottom corner.



For each action, a cone is drawn from the action position in the plane.

As the **Tourism B** cone overlaps all the other ones this action is preferred to all the other ones in the **PROMETHEE I** partial ranking.

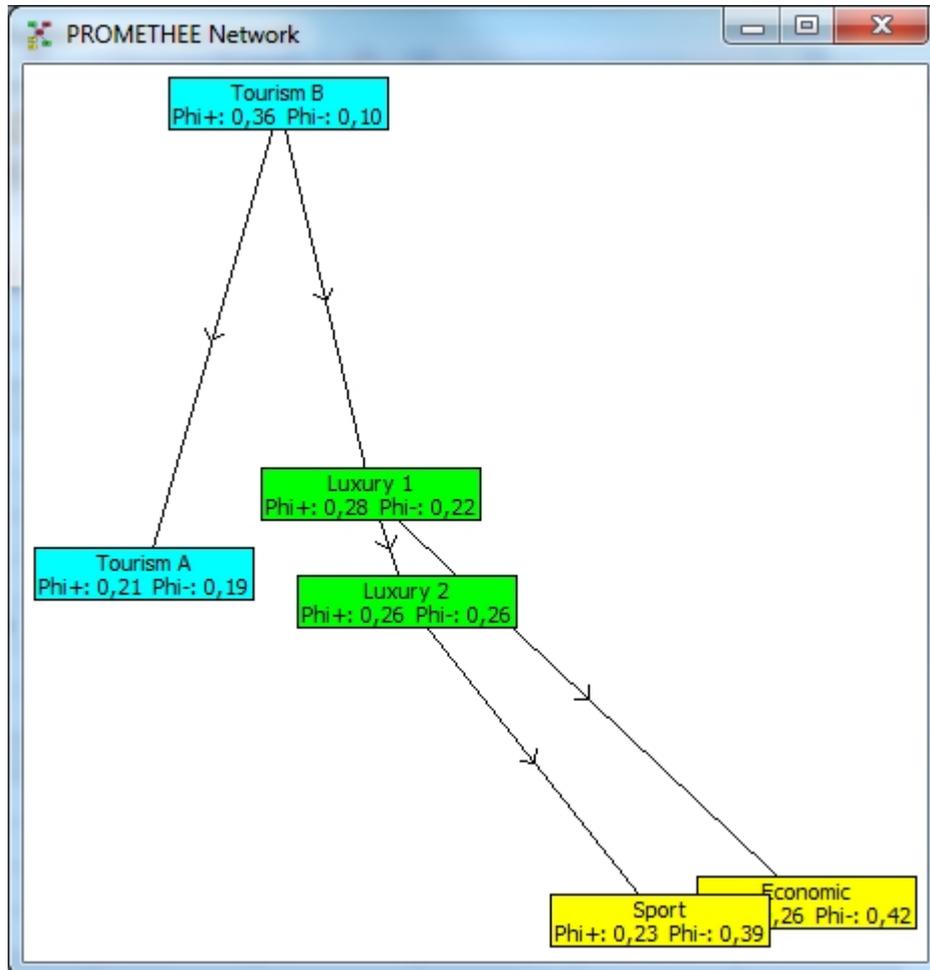
On the contrary the intersecting yellow cones corresponding to **Sport** and **Economic** indicate an incomparability.

An advantage of the **PROMETHEE** Diamond is that it is easy to visualize the proximity between Phi+ and Phi- scores globally.

PROMETHEE Network

Click "**PROMETHEE-GAIA | PROMETHEE Network**" to open this window.

The **PROMETHEE Network** representation of the **PROMETHEE I** Partial Ranking will feel familiar to the users of older **PROMETHEE** software such as **PromCalc** or **Decision Lab**. Actions are represented by nodes and arrows are drawn to indicate preferences. Incomparabilities are thus very easy to detect.

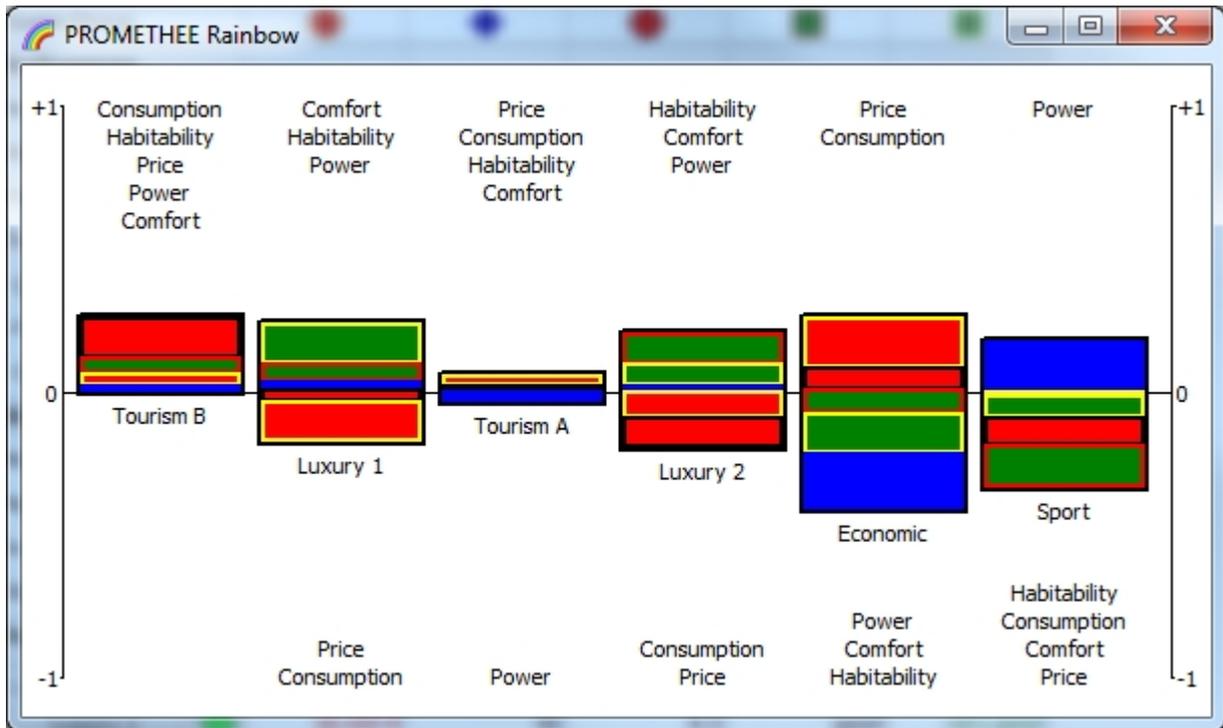


Visual PROMETHEE uses an enhanced network representation: instead of drawing the nodes at arbitrary locations the relative positions of the actions in the **PROMETHEE Diamond** are used. The network representation is like a close-up of the **Diamond** view where preferences are indicated by arrows. This makes it very straightforward to appreciate the proximity between actions and thus the degrees of incomparability in the partial ranking.

PROMETHEE Rainbow

Click "**PROMETHEE-GAIA | PROMETHEE Rainbow**" to open this window.

The **PROMETHEE Rainbow** is a disaggregated view of the **PROMETHEE II** complete ranking.



Actions are displayed from left to right according to the **PROMETHEE II** ranking: **Tourism B** to **Sport**.

For each action the stacked slices show the components of the action net flow. For instance:

- **Tourism B** exhibits no negative slices as all criteria contribute positively to its net flow score. This action presents no weaknesses with respect to the other actions. The larger red slice indicates that **Consumption** is the most important feature of this action. Its Phi score is positive.
- **Tourism A** has very small slices. It has no real weakness but also no real advantage. It is quite average. Its Phi score is close to zero.
- **Economic** is much more of a mixed bag with a very good **Price** (the upper red slice) and a very low **Power** (the lower blue slice). Globally, the negative slice more than compensate the positive ones and the Phi score is negative.

PROMETHEE Table

Click **PROMETHEE-GAIA | PROMETHEE Table** to open this window.

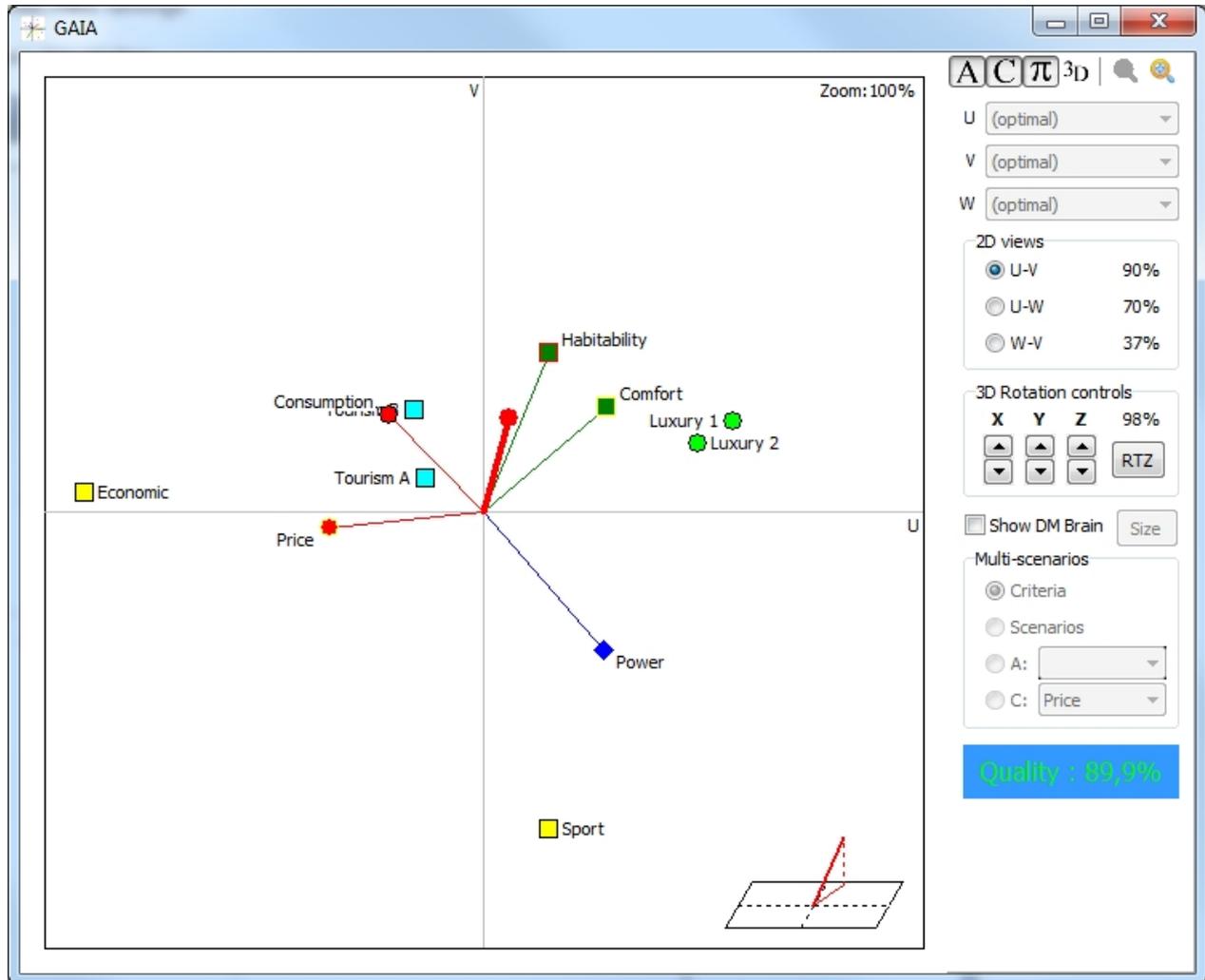
	Car	Phi	Phi+	Phi-
1	Tourism B	0.2573	0.3573	0.1000
2	Luxury 1	0.0547	0.2760	0.2213
3	Tourism A	0.0133	0.2060	0.1927
4	Luxury 2	-0.0013	0.2560	0.2573
5	Economic	-0.1573	0.2647	0.4220
6	Sport	-0.1667	0.2280	0.3947

The [PROMETHEE Table](#) displays the Phi, Phi+ and Phi- scores. The actions are ranked according to the **PROMETHEE II** complete ranking. This can be handy when the number of actions is large or to export the data to another program such as e.g. Excel (right-click the table to open the local menu and select **Copy** to copy the data to the clipboard).

The GAIA plane

The **GAIA** plane is a descriptive complement to the **PROMETHEE** rankings.

Click "**PROMETHEE-GAIA | GAIA Visual Analysis**" to open this window.



The **GAIA** analysis displayed when **Visual PROMETHEE** launches is a standard 2D (U,V) analysis.

GAIA starts from a multidimensional representation of the decision problem with as many dimensions as the number of criteria (five in this tutorial). A mathematical method called the Principal Components Analysis is used to reduce the number of dimensions while minimizing the loss of information.

In **Visual PROMETHEE** three dimensions are computed:

- U is the first principal component, it contains the maximum possible quantity of information,
- V is the second principal component, providing the maximum additional information orthogonal to U,
- W is the third principal component, providing the maximum additional information orthogonal to both U and V.

The standard **GAIA** analysis includes U and V only, as in older software such as PromCalc, Decision Lab, D-Sight or Smart Picker Pro. **Visual PROMETHEE** adds a third W component to improve the analysis when the (U,V) representation quality is too low.

The U, V, W list boxes are not functional yet. Currently optimal representations only are available.

The 2D views controls allow to switch between three 2D views:

- U-V: This is the best possible 2D view. In this tutorial it gathers 90% of information.
- U-W: With respect to the U-V view, it is viewed from the side (W is orthogonal to both U and V), it is of lower quality and it gathers only 70% of information in this tutorial.
- W-V: With respect to the U-V view, it is viewed from the top, it is thus the lowest quality 2D view available in **Visual PROMETHEE** and it gathers here only 37% of information.

Look at how the quality level is displayed at the bottom right of the window: its color changes from green to red to indicate the level of quality. Lower levels such as in the W-V plane make it difficult to draw reliable conclusions from the **GAIA** plane. In practice the 2D **GAIA** analysis is reliable when the quality level is above or close to 70%.

The above screenshot shows the U-V plane. It contains three types of information:

1. [Actions](#) are represented by points.
2. [Criteria](#) are represented by axes.
3. The [weighing](#) of the criteria and the **PROMETHEE II** ranking are represented by the **decision axis**.

Actions

Each action is represented by a point in the **GAIA** plane. Its position is related to its evaluations on the set of criteria in such a way that actions with similar profiles will be closer to each other. In this tutorial example we can identify four different types of profiles:

- Luxury cars (**Luxury 1** and **2**) are very close to each other. They are quite similar actions.
- Tourism cars (**Tourism A** and **B**) are also close to each other. They are also similar actions.
- The **Economic** car is on its own. It seems quite different from the other actions.
- The **Sport** car is also very different from the other actions.

To better understand the differences between these four groups of actions, we can have a look at the criteria.

Criteria

Each criterion is represented by an axis drawn from the center of the **GAIA** plane. The orientation of these axes is important as they indicate how closely the criteria are related to each other:

- Criteria expressing similar preferences have axes that are close to each other.
- Conflicting criteria have axes that are pointing in opposite directions.

It is thus possible to identify groups of criteria expressing similar preferences and to better understand the conflicts that have to be solved in order to make a decision. In this tutorial, three such groups can be identified:

- **Habitability** and **Comfort** are close to each other. This means that based on the data cars exhibiting a higher comfort level have also a higher habitability level. It is thus possible to find solutions (cars) that are good on both criteria at the same time. These criteria could be associated to the general objective of "**Luxury**".
- **Price** and **Consumption** are also relatively close to each other. So we can expect cheaper car to be more fuel efficient. Or... more expensive cars to be less fuel efficient. These two criteria could be associated to a general objective of "**Economy**".
- Finally, **Power** is on its own and seems to be conflicting with most other criteria.

Given the different orientation of the three aforementioned groups, we can conclude that the decision maker will have to conciliate three conflicting objectives: luxury, economy and power.

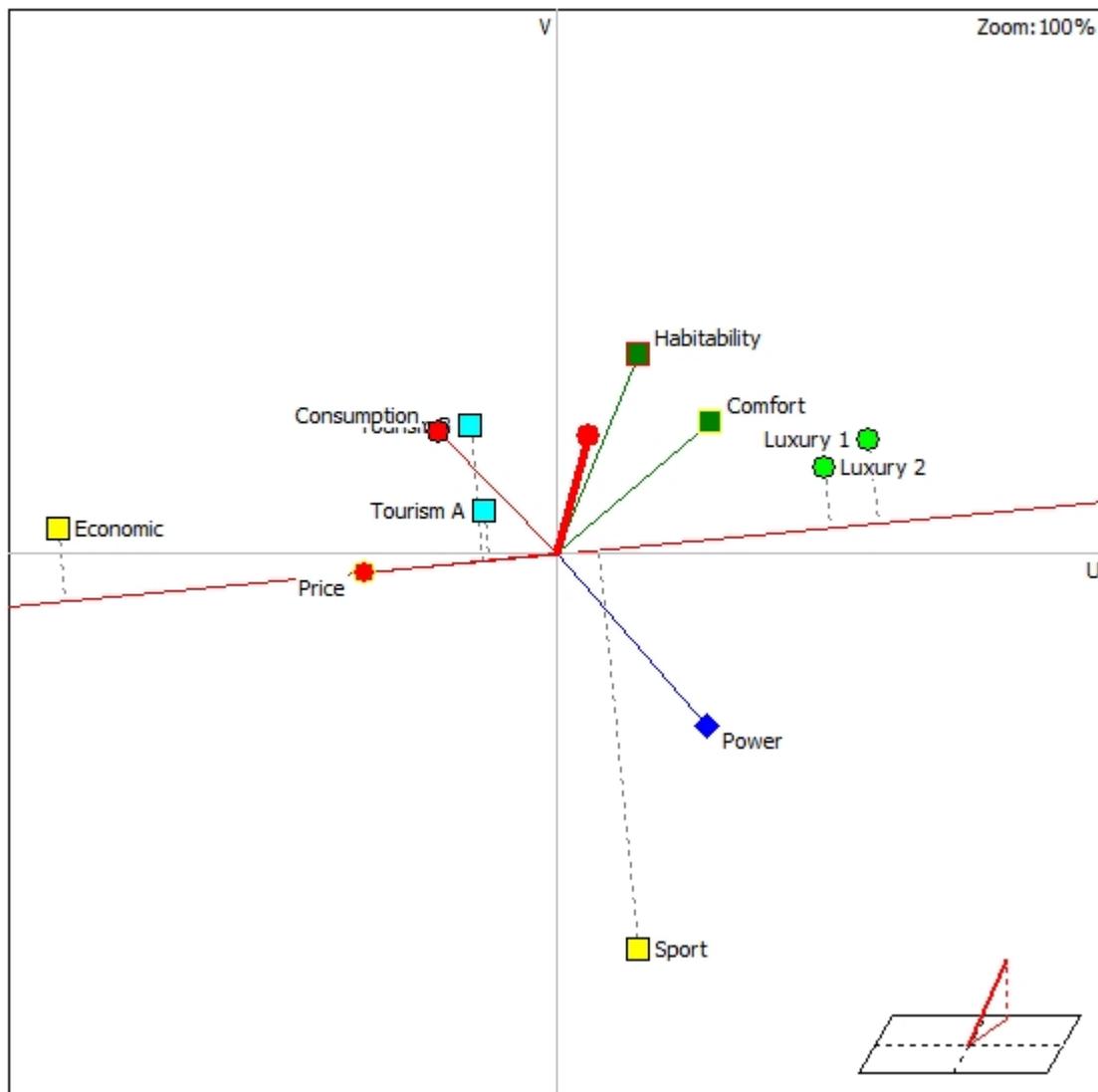
The length of the criteria axes is also relevant. Indeed the longer an axis the more discriminant the criterion. For instance the axis for **Power** is longer than the axis for **Consumption**: the range for **Power** is 60 kW (twice the P threshold for that criterion) while the range for **Consumption** is 2L (once the P threshold). The variations observed on the **Power** criterion are thus felt more important for the decision maker than variations observed on criterion **Consumption**. Discrimination is different from the weight of the criterion. The **Price** criterion can be very important for the decision maker but if all prices are in a 100€ range this criterion will not be discriminant at all.

Actions and criteria

The relative positions of actions and criteria are also interesting to analyze.

Indeed the orientation of a criterion axis indicates where the best actions for this criterion are located.

Let us take criterion **Price** as an example. Right-click on the **GAIA** plane to open the local menu and select "Show axis | Price". A line is drawn along the **Price** axis and the actions are projected orthogonally to that line.



What is important is not how far an action is from the criterion axis but rather how it projects itself on the direction of the axis. In this tutorial example, we see that:

- **Economic** is clearly the cheapest car as it project completely to the left side.
- **Tourism A** and **B** the second best choices with respect to **Price**. They are very close to each other.
- **Sport** is slightly more expensive than the Tourism cars.
- **Luxury 1** and **2** are very close to each other and are the most expensive cars.

This information is of course highly dependent on the quality of the **GAIA** plane. For lower quality level one can expect more distortions with respect to actual evaluations. Indeed a lower quality level means that it is more difficult to have an accurate 2D representation of the multicriteria problem.

Looking globally at the different criteria it is now possible to better explain the different action profiles:

- Luxury cars (**Luxury 1** and **2**) are good on **Comfort** and **Habitability** and not so bad on **Power**. But they are weak on **Price** (expensive) and **Consumption**.
- Tourism cars (**Tourism A** and **B**) are more average (central) cars.
- The **Economic** car is the best for **Price** (it is the cheapest), its is good on **Consumption** but really bad on the other criteria.
- The **Sport** car is the most powerful one. But that is its only good feature.

Decision Axis

The decision axis (the thicker red axis) is a representation of the weighing of the criteria. It is similar to a criterion axis but for an important point: the representation of the decision axis is not optimal. When the weight of the criteria are modified, the **GAIA** plane is not. Only the decision axis is modified. Thus shorter decision axes are less reliable.

The orientation of the decision axis indicate which criteria are in agreement with the **PROMETHEE** rankings and which are not. In this tutorial, the decision axis is opposite to the **Price** and **Power** criteria which means that one can expect to find rather expensive and not so powerful cars at the top of the **PROMETHEE** rankings. If this is not consistent with the decision maker objectives it probably means that these criteria have been under-weighted.

The decision axis can thus be used as a tool to analyze the type of compromise corresponding to the current weighing of the criteria and to help to better define the weights of the criteria.

The decision axis is actually the projection of the **Decision Stick** (i.e. the axis representing the weights of the criteria in the criteria space) onto the **GAIA** Plane. A three-dimensional representation of the Decision Stick can be displayed in the [GAIA window](#) (at the lower right corner in the above screenshots).

Additional analysis

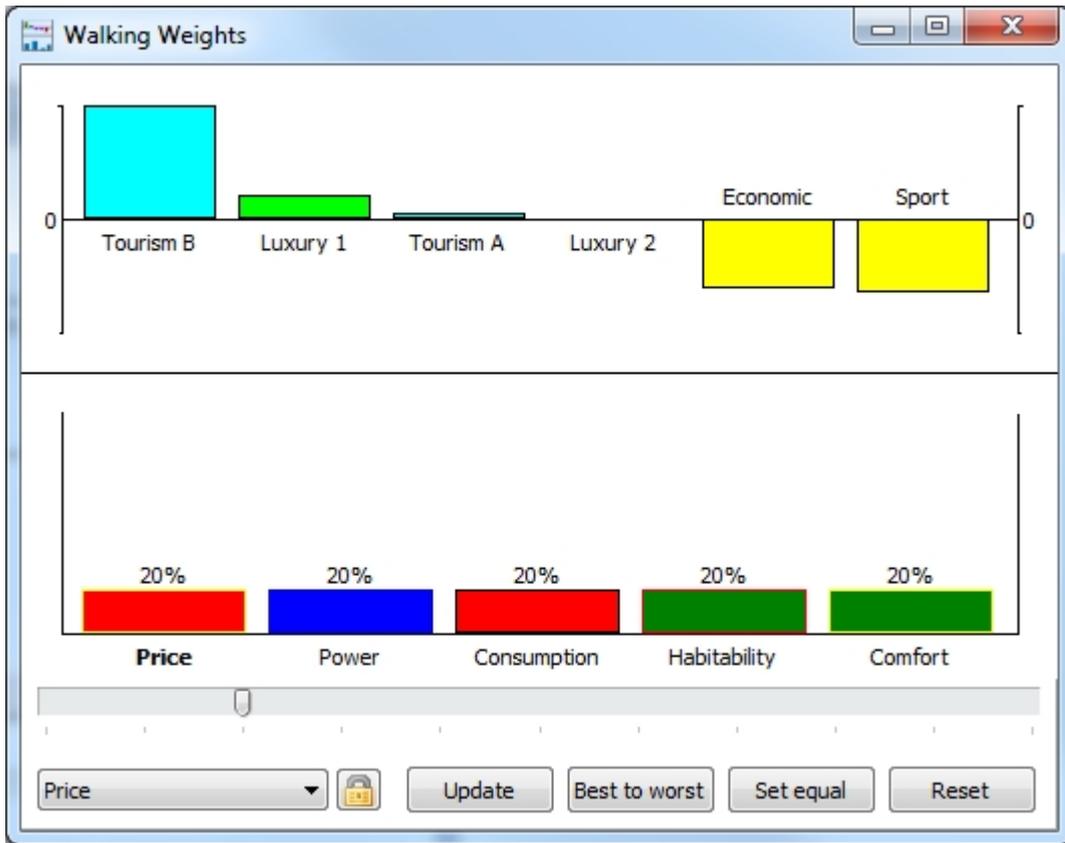
The [GAIA window](#) includes many other analysis possibilities that are described in the corresponding [page](#). More information about the theoretical foundations of **GAIA** can also be found [here](#).

The Walking Weights

Visual PROMETHEE provides you with several tools to perform an extensive weight sensitivity analysis on your data.

Walking Weights

Click "**PROMETHEE-GAIA | Walking Weights**" to open this window.



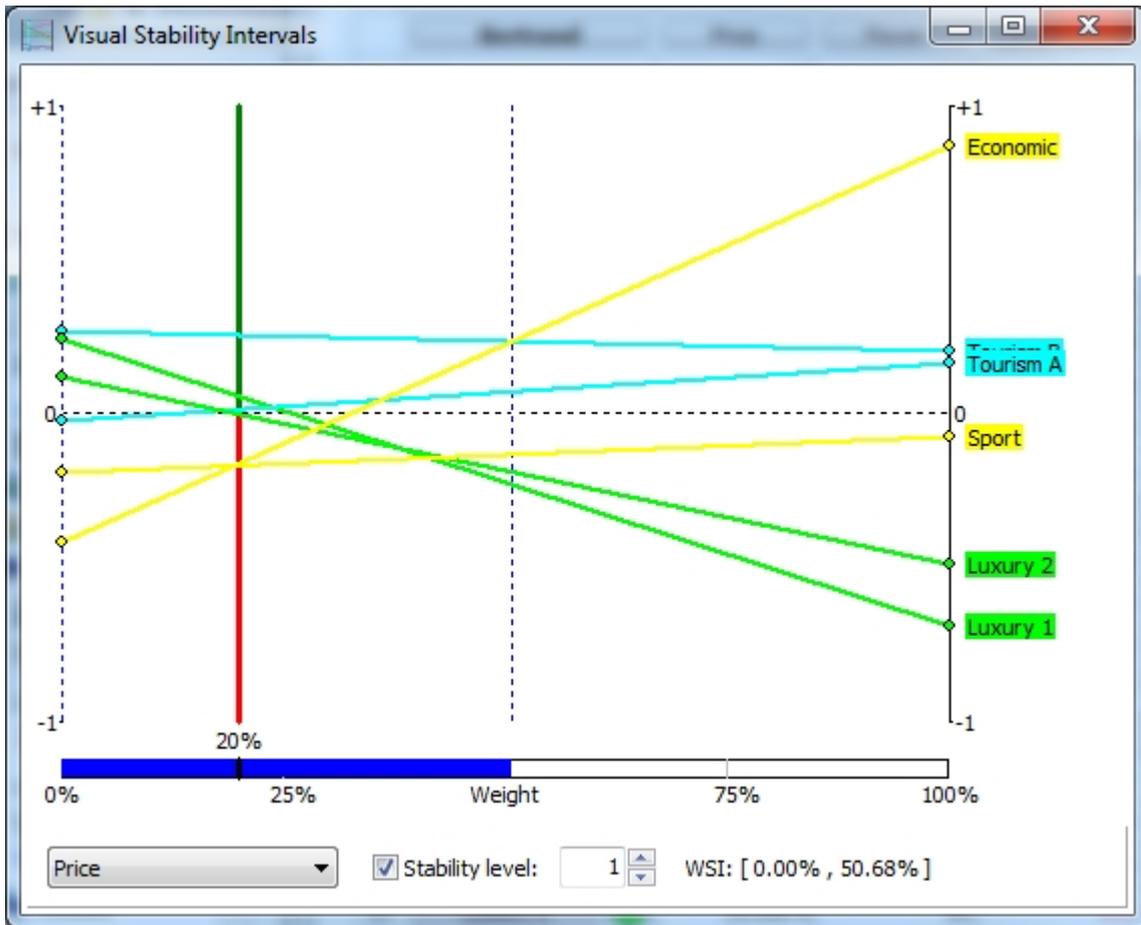
The **Walking Weights** window allows you to change the weights of the criteria and see the impact on the **Visual PROMETHEE** analysis.

The window is split into two parts:

- The upper part is a bar chart showing the **PROMETHEE II** Complete Ranking.
- The lower part is a bar chart showing the weights of the criteria.

The slider allows to change the weight of the selected criteria and to see the impact on the **Visual PROMETHEE** analysis. All opened windows are automatically updated.

A more precise and thorough weight stability analysis can be done using the [Visual Stability Intervals](#). The screenshot below shows the visual stability analysis for criterion **Price**.



The horizontal axis is the weight of the criterion from 0% to 100%.

The vertical axis is the **PROMETHEE** net flow.

For each active action a line is drawn that shows how the net value change when the weight of the criterion is modified. In this case it can be seen that **Tourism B** is at the top of the **PROMETHEE II** ranking for a wide range of weight.

Working with multiple scenarios

To learn about working with multiple scenarios in **Visual PROMETHEE** you are first going to load another dataset.

In the [Main Menu](#), click **File** and then **Open**. Find the **TutorSites.vpg** file (it should be located in the **Visual PROMETHEE** install folder) and open it.

The screenshot shows the Visual PROMETHEE Business software interface. The main window displays a table with the following data:

	Investment	Operations	Employment	Transportation	Environ. Imp.	Social Imp.
Unit	M\$	M\$	workers	5-point	impact	impact
Cluster/Group	◆	◆	◆	◆	◆	◆
Preferences						
Min/Max	min	min	min	max	min	min
Weight	25.00	15.00	20.00	20.00	10.00	10.00
Preference Fn.	Linear	Linear	Linear	Level	Level	Level
Thresholds	percentage	percentage	percentage	absolute	absolute	absolute
- Q: Indifference	0.05	0.05	0.05	0.5	0.5	0.5
- P: Preference	0.25	0.25	0.1	1.5	1.5	1.5
- S: Gaussian	n/a	n/a	n/a	n/a	n/a	n/a
Statistics						
Minimum	74 €	7 €	95	2.0	1.0	1.0
Maximum	128 €	12 €	175	5.0	4.0	4.0
Average	98 €	9 €	139	3.6	2.4	2.2
Standard Dev.	20 €	2 €	32	1.0	1.0	1.2
Evaluations						
<input checked="" type="checkbox"/> Site 1	74 €	12 €	175	average	high	low
<input checked="" type="checkbox"/> Site 2	86 €	9 €	170	good	low	very low
<input checked="" type="checkbox"/> Site 3	89 €	7 €	145	very good	very low	moderate
<input checked="" type="checkbox"/> Site 4	115 €	8 €	95	bad	low	high
<input checked="" type="checkbox"/> Site 5	128 €	10 €	110	good	moderate	very low

At the bottom of the interface, there is a status bar showing: Actions: 5 (5 active) Criteria: 6 (6 active) Scenarios: 4 (4 active) Locale: Belgium [€/.] Saved

This dataset corresponds to a location problem. An industrial company wants to build a new plant and hesitates between five different locations (**Site 1** to **Site 5**).

Six criteria are considered relevant to compare the five locations:

- **Investment:** This is the investment cost in million Euros. It should be minimized.
- **Operations:** This is the annual operating cost. It is also expressed in million Euros and has to be minimized as well.
- **Employment:** This is the number of workers required to run the plant. Different locations correspond to different plant configuration or different technologies, so the choice has an impact on that number. As it

is linked to salaries and to social costs, this criterion should be minimized.

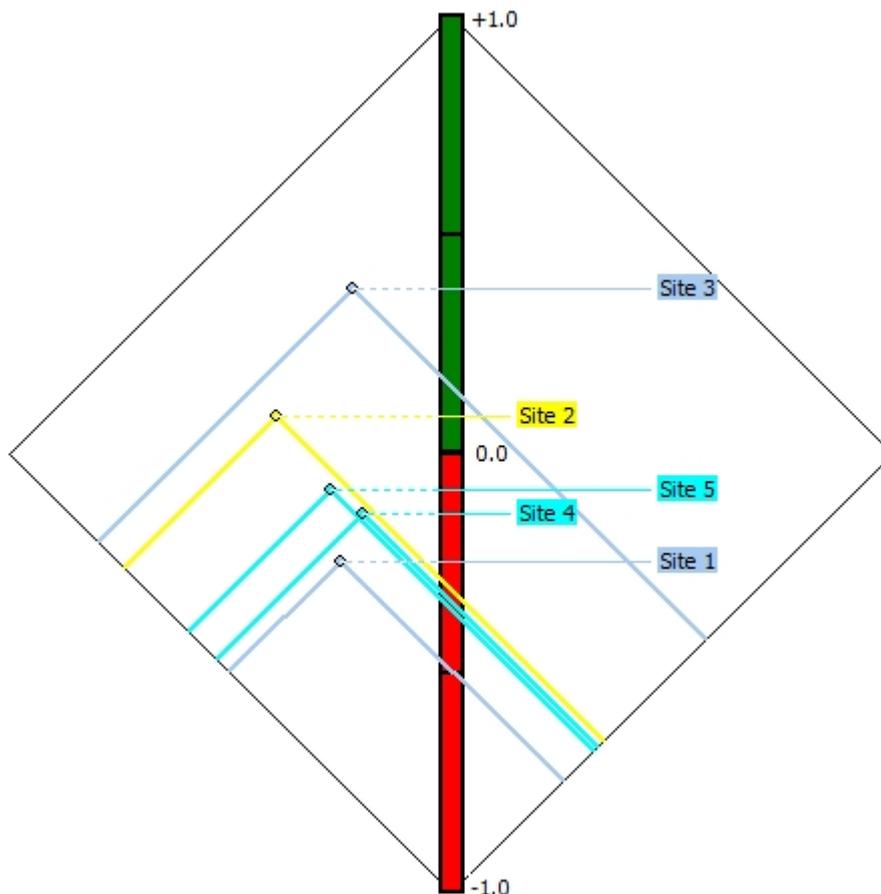
- **Transportation:** This is a qualitative criterion that evaluates the site adequacy with respect to transportation. It encompasses factors such as the proximity to transportation networks, the distance to suppliers and to customers, etc. It is expressed on a 5-point scale (very bad to very good).
- **Environment:** This is a global evaluation of the environmental impact, on a 5 point impact scale: from very low (best) to very high (worst).
- **Social:** This is a global evaluation of the social impact, on the same 5 point impact scale: from very low (best) to very high (worst).

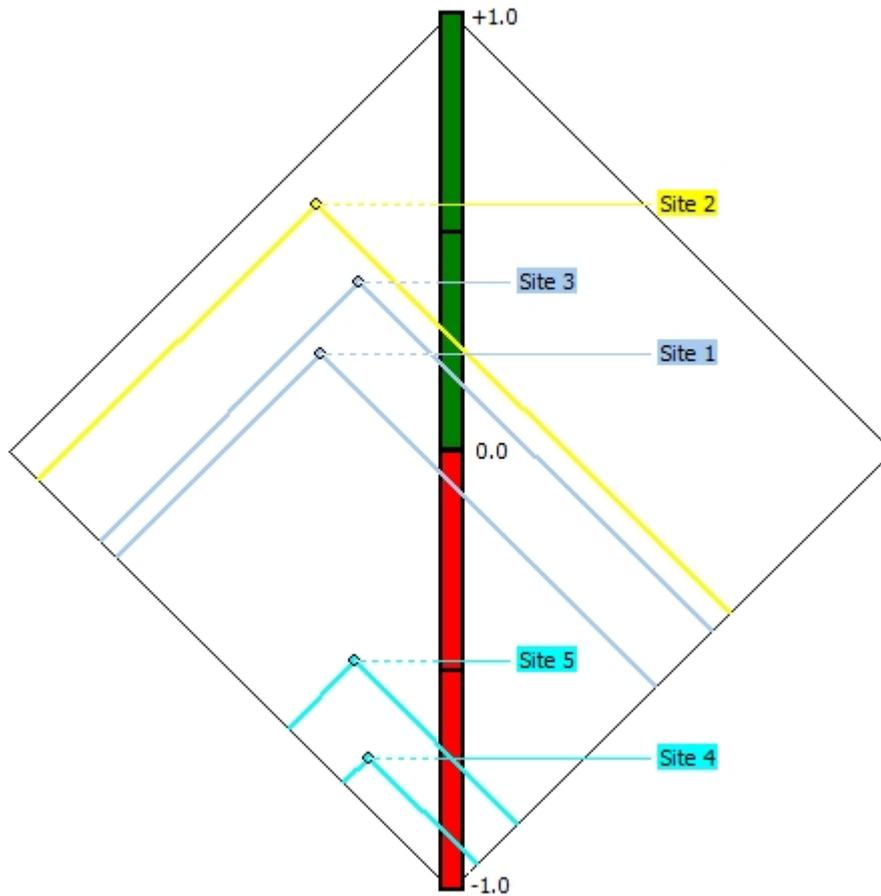
At the bottom of the spreadsheet, there are five tabs corresponding to five different scenarios. Each scenario represents the point of view of one stakeholder:

- **Industrial:** This is the point of view of the actual decision maker, of the company that wants to build the new plant.
- **Political:** This is the point of view of the regional political authority that has to allow the permit for building the plant.
- **Environmental:** This is the point of view of environmental associations within the region. They have some influence on the industrial decisions made in the region.
- **Social:** This is the point of view of the worker's unions. They also have some influence on industrial decisions as these are linked to the creation of jobs in the region.

Click on the tabs to switch from one scenario (point of view) to another. As you can see the preference parameters and even the criteria evaluations for more subjective criteria do change from one scenario to another.

The complete **Visual PROMETHEE** analysis is performed separately for each scenario. Here are the **PROMETHEE Diamonds** for scenarios **Industrial** (left) and **Social** (right):

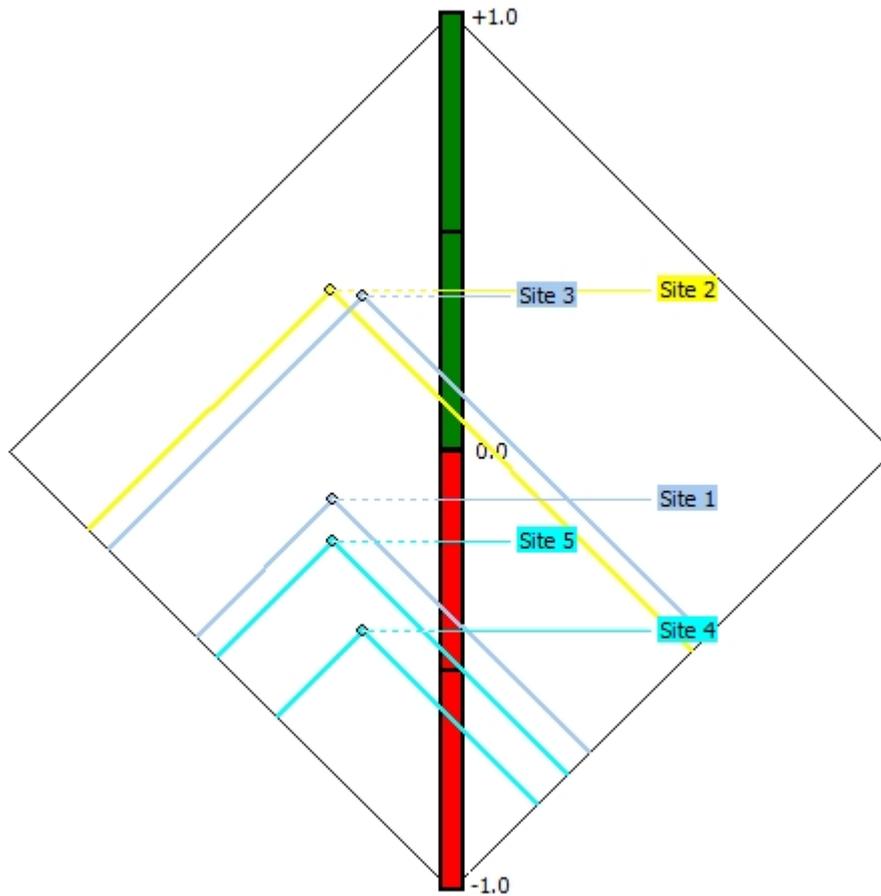




For the **Industrial** scenario, **Site 3** is clearly the best choice, and **Site 1** is the worst one. There is a slight incomparability between **Site 5** and **Site 4**.

For the **Social** scenario, there is no incomparability and **Site 2** is the preferred choice. There is also a wider spread between the best and worst actions. That means that stronger preferences are expressed to differentiate actions in this scenario.

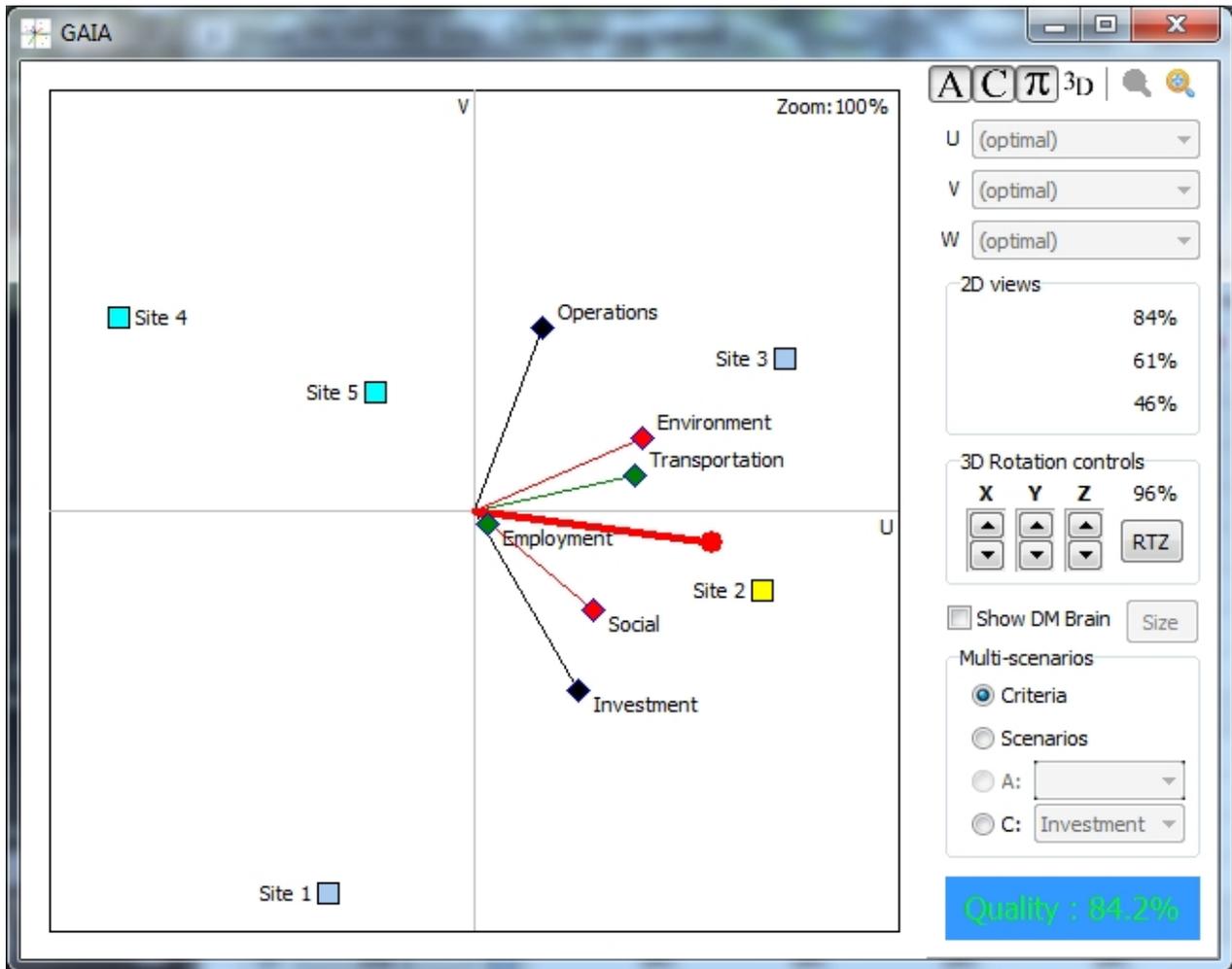
The "**All**" tab can be selected to perform the analysis on all the scenarios at the same time. In this case the [weighing](#) of the scenarios is taken into account to produce a consensus **PROMETHEE** ranking and several **GDSS** analyses. Here is the **PROMETHEE Diamond** for the consensus ranking:



Two actions appear clearly at the top of the ranking: **Site 2** and **Site 3**. They are incomparable in **PROMETHEE I**. That can be explained easily: **Site 2** is the best choice for scenarios **Environmental** and **Social** while **Site 3** is the best for scenarios **Industrial** and **Political**. It is thus very difficult to choose between these two actions. That is reflected in the **PROMETHEE I** partial ranking.

Besides the **PROMETHEE** rankings there are several **GDSS** extensions to the **GAIA** analysis that can be helpful to better understand the different points of view in a **GDSS** context. When the "All" scenarios tab is selected in the **Visual PROMETHEE** spreadsheet the following four "Multi-scenarios" options become available on the right side of the **GAIA** window:

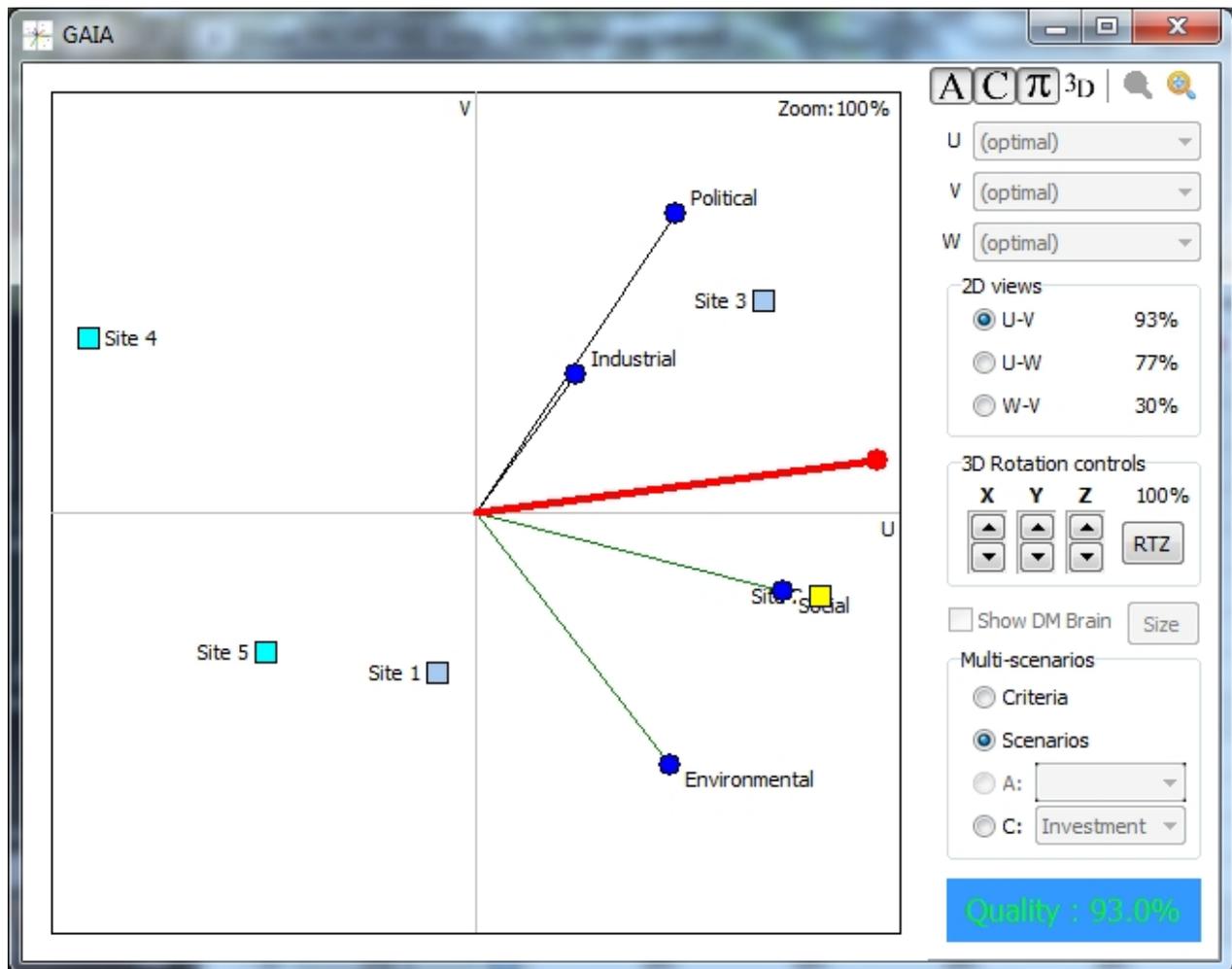
- Criteria**
 This is the regular **GAIA-Criteria** display where axes correspond to the criteria (or groups). In the **GDSS** context however this display will not show any evaluation differences between scenarios. Instead "average" evaluations will be shown. This can be misleading in case of subjective evaluations. Here is the **GAIA-Criteria** plane for the tutorial example:



There are not so many conflicts apparent as all criteria axes are oriented to the right. **Site 2** and **Site 3** also appear to be the best choices globally. But no information is available on the way each criterion has been evaluated by the different decision makers.

- **Scenarios**

In this **GAIA-Scenarios** analysis axes correspond to the scenarios. They show the disagreements between the different scenarios. Here is the result for the tutorial example:



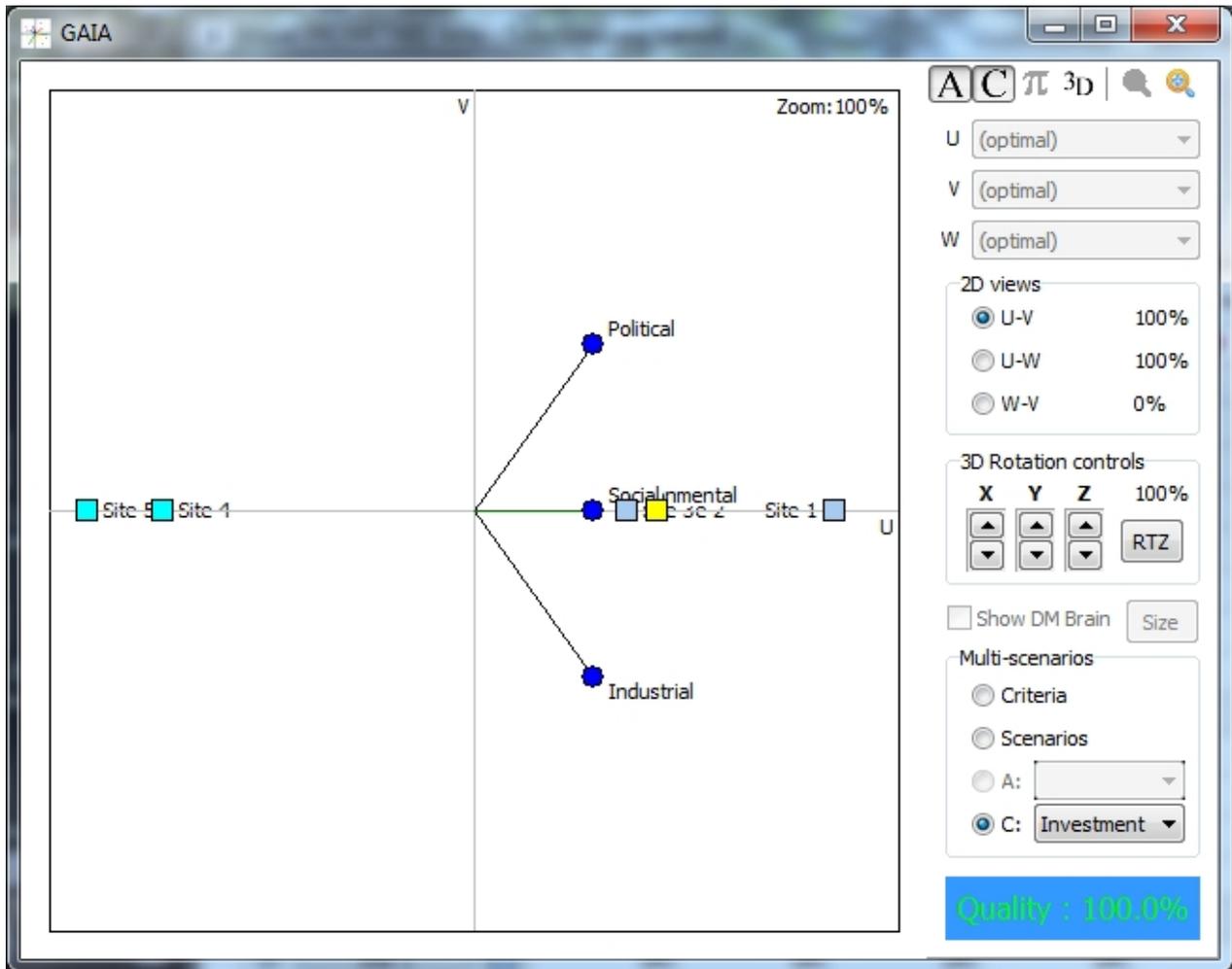
Two groups of decision makers appear: **Industrial** and **Political** are very close to each other and prefer **Site 3** while **Environmental** and **Social** prefer **Site 2**. Globally there is no very strong conflict as all the axes are oriented to the right.

- **A: single action**

This analysis is not implement yet.

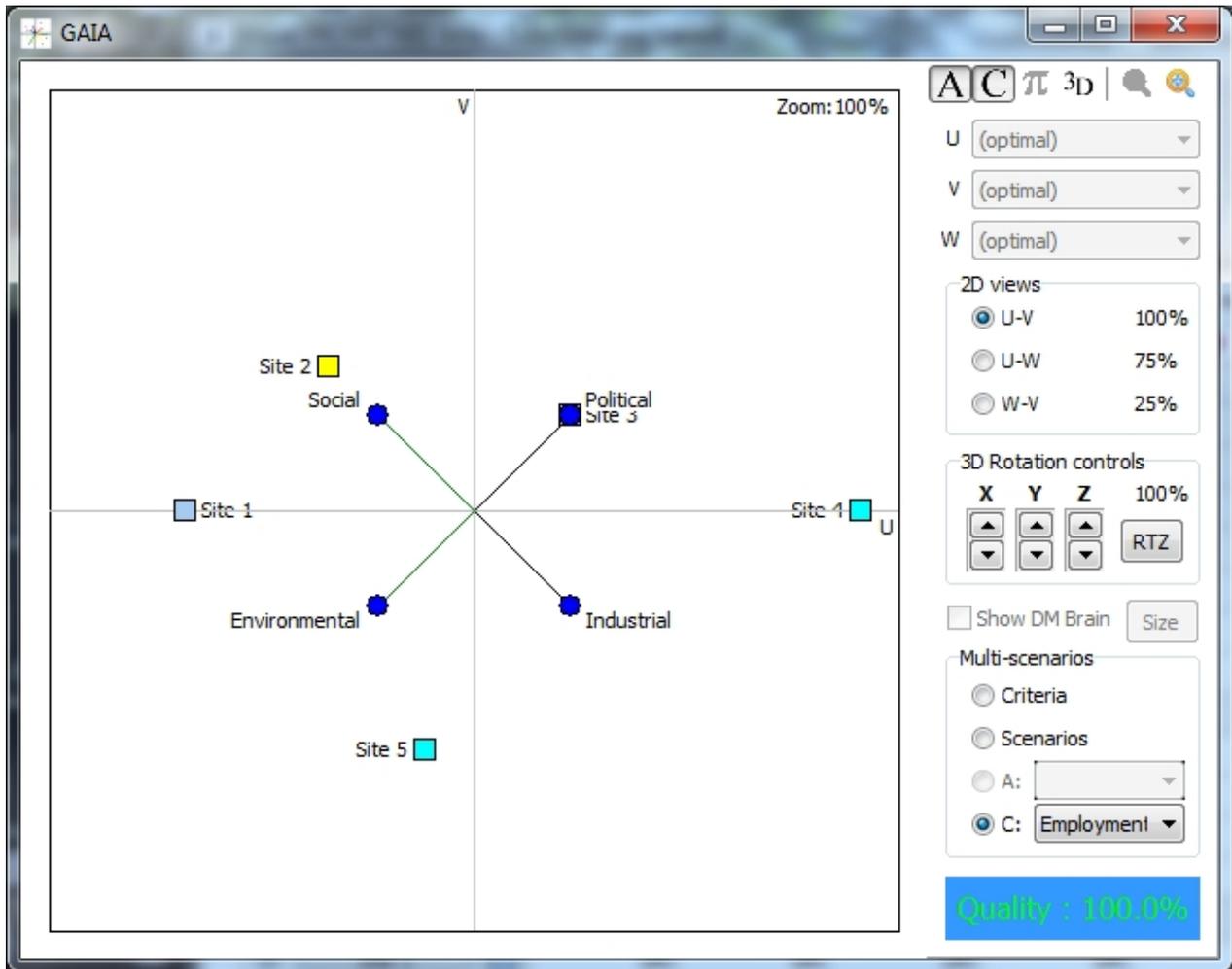
- **C: single criterion**

In the **GAIA-Uncriterion** analysis a single criterion is compared over the different scenarios. This can be helpful to identify the sources of disagreement within a group of decision makers. Here are two very different examples. First the **Investment** criterion is selected.



This is an "objective" criterion for which the evaluations are the same in all the scenarios. The only differences can arise from the choice of the preference functions. In this case, all the actions are on a straight line as they are evaluated in the same way in all the scenarios.

For the second example the criterion **Employment** has been selected. The positions of the axes indicate that this criterion has been evaluated very differently in the four scenarios.



- **Site 4** is preferred by **Political** and **Industrial**. But not by **Environmental** and **Social**.
- **Site 1** and **Site 5** are preferred by **Environmental** but not at all by **Political**.

This shows that this criterion is evaluated very differently from one decision maker to another. Possibly because they do not understand the definition of the criterion in the same way. This can be a source of conflict and can make the decision making process more difficult. The **GAIA-Uncriterion** analysis can help to discover such situations and be a basis for establishing a better discussion basis: for instance the definition of the criterion could be modified or the criterion could be split into sub-criteria or the evaluation could be reviewed by the decision maker.

Starting a new problem

Let us go through the process of defining a new problem and analyzing it with **Visual PROMETHEE**.

1. The problem

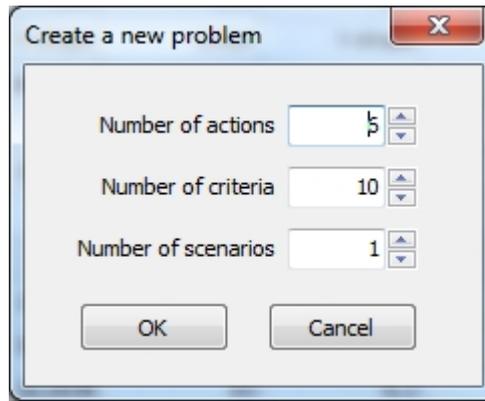
Aouatif is a young Ph.D. student in biology. She wants to use the **PROMETHEE-GAIA** methodology for her research. She doesn't know which software to use and she decides to make a multicriteria evaluation of the available software.

The following software are available:

- **PromCalc**: a very old piece of software (last century tech) but yet very simple to use, provided you can still install it on a recent computer.
- **Decision Lab 2000**: more recent, but not supported anymore and a bit limited with respect to today's standards.
- **D-Sight**: this newer program is not very nice-looking and it is relatively expensive but is backed by a "dream team" of young entrepreneurs driving (low end) BMW's... who knows where they will be next year?
- **Smart-Picker Pro**: that's the outsider. Nobody knows where it comes from... It looks OK even if a bit on the rough edge but... is it coming from the dark side of the **PROMETHEE** force?
- **Visual PROMETHEE**: the newest and most complete implementation of the **PROMETHEE** and **GAIA** methods, but still in a late beta stage.
- **DIY**: of course Aouatif could also develop her own software using MS Excel, MathLab or a programming language. (for non-English speakers: DIY = Do It Yourself)

2. The model

- **The actions**
The [actions](#) of the problem are the different software available. There are thus six actions.
- **The criteria**
What is important to keep in mind when comparing software? For Aouatif the following criteria should be considered:
 - **Price**: how much does it cost?
 - **Support**:
 - **Scientific**: is it backed by experts?
 - **Technical**: do they have a sufficient technical support level?
 - **Functions**:
 - **Data management**: how easy is it to import/export/manage data?
 - **Analysis**: what types of analyses are available?
 - **Interface**: is it easy to use?
 - **Installation**: Windows 8 compatible?
 - **Documentation**: is documentation available (manual/help/tutorials)?
 - **Localization**: is it available in my language?
 - **Evolution**: will they still be there next year?
- **Defining a new problem in Visual PROMETHEE**
Let us define a new problem: click the menu item "File | New".
A window appears where you should set the numbers of actions, criteria and scenarios.



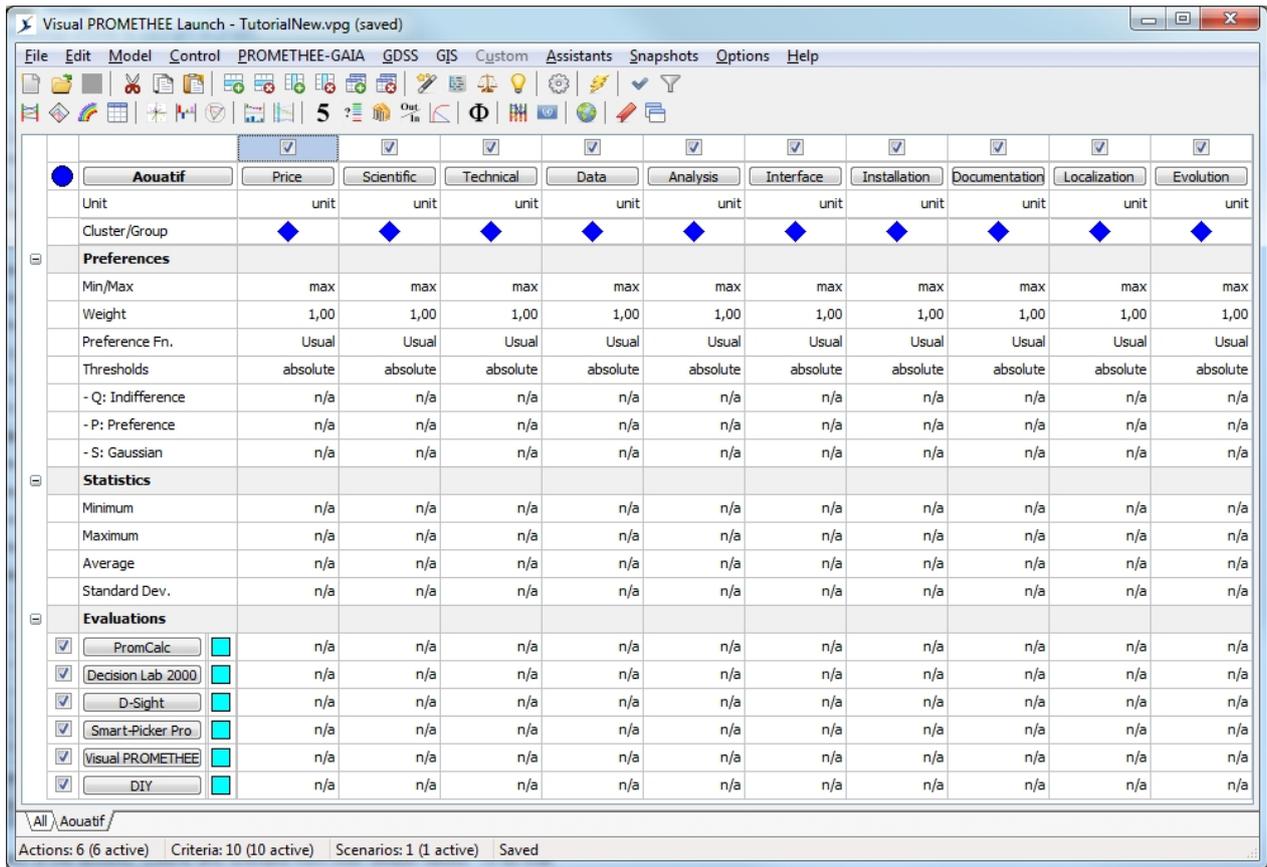
There are six actions (the software to compare), ten criteria and a single scenario (Aouatif is the only one to decide). Adjust the fields as in the above screen-shot and click "OK". An empty spreadsheet appears (see below).

Scenario1	criterion1	criterion2	criterion3	criterion4	criterion5	criterion6	criterion7	criterion8	criterion9	criterion10
Unit	unit	unit	unit	unit	unit	unit	unit	unit	unit	unit
Cluster/Group	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Preferences										
Min/Max	max	max	max	max	max	max	max	max	max	max
Weight	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Preference Fn.	Usual	Usual	Usual	Usual	Usual	Usual	Usual	Usual	Usual	Usual
Thresholds	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute
- Q: Indifference	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
- P: Preference	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
- S: Gaussian	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Statistics										
Minimum	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Maximum	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Standard Dev.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Evaluations										
<input checked="" type="checkbox"/> action1	<input type="checkbox"/>	n/a								
<input checked="" type="checkbox"/> action2	<input type="checkbox"/>	n/a								
<input checked="" type="checkbox"/> action3	<input type="checkbox"/>	n/a								
<input checked="" type="checkbox"/> action4	<input type="checkbox"/>	n/a								
<input checked="" type="checkbox"/> action5	<input type="checkbox"/>	n/a								
<input checked="" type="checkbox"/> action6	<input type="checkbox"/>	n/a								

You should first change the names of the actions, criteria and scenario from their default values. To do that:

- for the actions, open the [Actions](#) dialog by either selecting from the menu "Model| Actions..." or clicking on an action name button ("action1", ...) in the spreadsheet.
- for the criteria, open the [Criteria](#) dialog by either selecting from the menu "Model| Criteria..." or clicking on a criterion name button ("criterion1", ...) in the spreadsheet.
- for the scenario, open the [Scenarios](#) dialog by either selecting from the menu "Model| Scenarios..." or clicking on the scenario name button ("Scenario1") in the spreadsheet.

Enter appropriate actions, criteria and scenario names. The resulting spreadsheet should look like the one below.



You still have to enter the evaluations. But...

o **The scales**

Before we go further we have to think about scales.

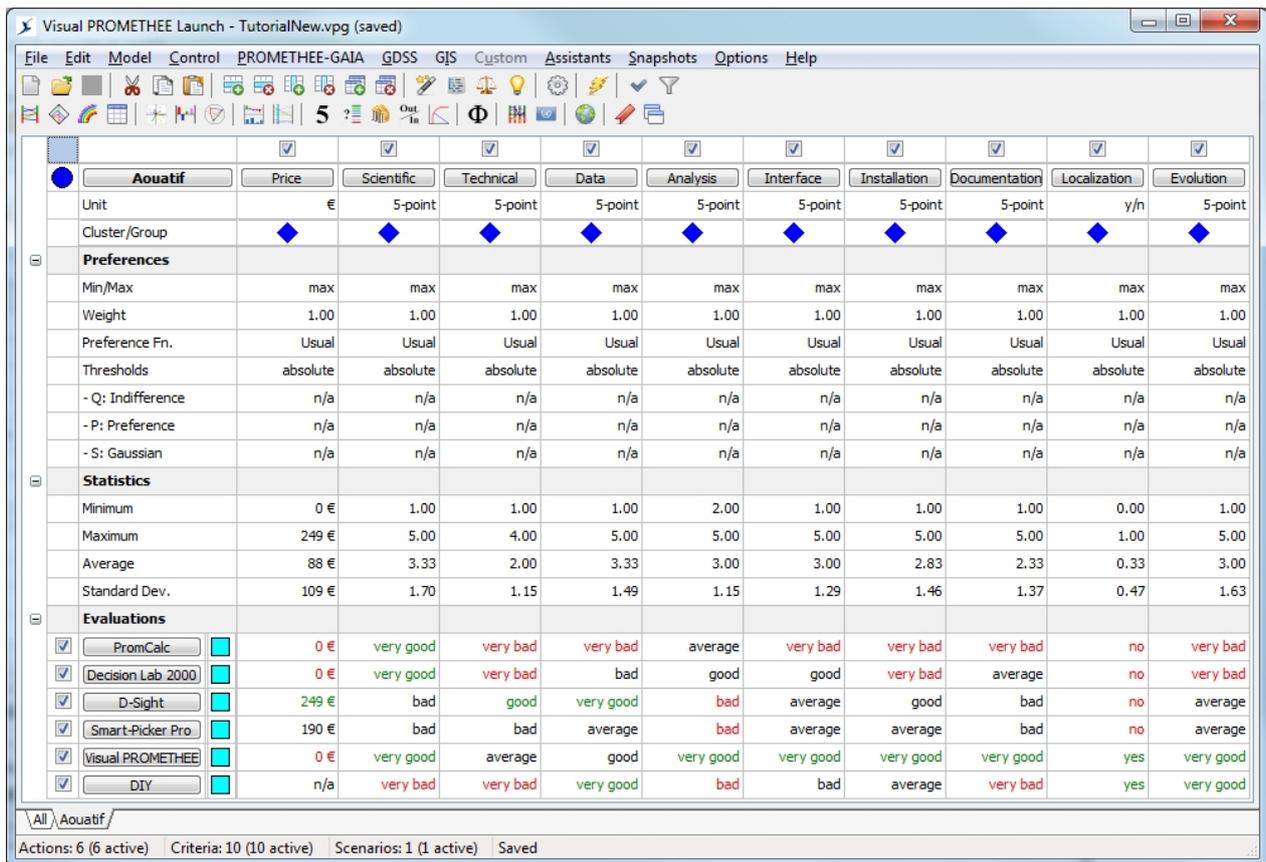
Some are obvious as the **Price** criterion: it is simply the price of the license expressed here in Euros (€). But most others here are qualitative scales and you have first to define them.

For many qualitative criteria a 5-point scale (very good, good, average, bad, very bad) is appropriate. That is why it is predefined in **Visual PROMETHEE**.

To define the scales of the criteria do the following. For each criterion open the **Criteria** dialog by either selecting from the menu "Model|Criteria..." or clicking on a criterion name button ("Price", ...) in the spreadsheet. Then select the right **Scale** type:

- "currency" for the **Price** criterion,
- "qualitative" for the other criteria, once "qualitative" is selected the qualitative scales drop-down list is activated just below the "Scale" field and you should select "5-point" from this list.
- For the **Localization** criterion, it is more simple: it can be localized to your country/ language or not, so you should select the "y/n" (yes/no) scale.

Once the scales are properly defined, the evaluation table can be filled. According to the software characteristics, Aouatif has filled the table as it appears below:



Aouatif wants to visually identify the free software from the paid ones so she decides to create two [categories](#) of actions:

- **Free:** this category includes **PromCalc**, **Decision Lab 2000** (as both are discontinued) and **Visual PROMETHEE** (Academic Edition).
- **Paid:** this includes **D-Sight** and **Smart-Picker Pro**.
- The **DIY** solution is different as it involves development time. As such it will be left outside of the two categories.

To define categories:

- Open the [Action Categories](#) dialog using the menu item "**Model | Action Categories...**".
- Click "**New**" to create a new category and enter "**Free**" in the "**Name**" field.
- Choose a shape and a color to identify this category.
- Repeat the procedure for the "**Paid**" category.
- Click "**Close**" to close the dialog.

Now that the categories are created the next step is to assign actions to the categories:

- Click the "**PromCalc**" button to open the [Actions](#) dialog.
- In the **Category** drop-down list select "**Free**".
- Click "**Close**".
- Repeat the procedure for "**Decision Lab 2000**" and for "**Visual PROMETHEE**".
- Notice how the symbol and/or color change for these actions.
- Repeat the procedure for "**D-Sight**" and "**Smart-Picker Pro**" with the "**Paid**" category.

As there are many criteria and some are closely related to each other we are also going to define two groups of criteria:

- **Support:** Support includes **scientific** support (availability of scientific experts to

answer calls) as well as **technical** support (availability of computer scientists to answer technical calls).

- **Function:** Includes **data** management functions (import/export) as well as **analysis** capabilities.

Visual PROMETHEE allows for a three-level [hierarchy](#) of criteria with [groups](#) and [clusters](#). For this case we only need a two-level hierarchy with some criteria grouped together. Here is how you should proceed in such a case:

- Open the [Clusters](#) dialog using the menu item "**Model | Clusters...**".
- Click "**New**" to create a new cluster and enter "**Support**" in the "**Name**" field.
- Choose a shape and a color to identify this cluster.
- Click "**Clone**" to automatically generate a criteria group with the same name.
- Repeat the procedure to create another cluster named "**Function**".
- Click "**Close**" to close the dialog.

Now that the clusters are created the next step is to assign criteria to the clusters:

- Click the "**Scientific**" button to open the [Criteria](#) dialog.
- In the **Group** drop-down list select "**Support**".
- Click "**Close**".
- Repeat the procedure for "**Technical**".
- Notice how the symbol and/or color change for these criteria.
- Repeat the procedure for "**Data**" and "**Analysis**" with the "**Function**" group.

What about preferences? Currently all criteria are set to be maximized. They have equal weights and the preference functions are all set to "**Usual**". Let us proceed now with preference modeling.

○ **The preference parameters**

For each criterion, you have to:

- decide whether it has to be maximized or minimized,
- choose a [preference function](#) and set the values of the corresponding thresholds.

For this problem, it is obvious that **Price** should be minimized: indeed Aouatif prefers to pay less for the software and to save money. The other criteria use qualitative scales that were set up in such a way that they should be maximized. In the **Visual PROMETHEE** spreadsheet change the "**Min/Max**" field for criterion **Price** so that it reads "**min**" instead of "**max**".

The choice of the preference functions is a more difficult step. For qualitative criteria including a small number of evaluation levels the **Usual** preference function is usually a good choice. But for the **Price** criterion small price differences should not be accounted for as much as larger ones. For such a criterion the **Linear** preference function is appropriate. Click on the "**Preference Fn.**" cell for criterion **Price** and change the value from **Usual** to **Linear** in the drop-down list. You now have to change the default values for the indifference (Q) and preference (P) thresholds. Aouatif feels that a 10€ price difference is negligible (she doesn't mind to pay 10€ more) but a 50€ price difference is quite important with respect to the license price range of the software. So Q will be set to 10€ and P to 50€. Change the values accordingly in the spreadsheet (Hint: change P first as **Visual PROMETHEE** won't allow a Q value larger than the current P value).

For the moment we will leave the weights to their initial values (1.00). All criteria thus have the same weight. We will change this later.

The resulting dataset shown in the screenshot below is available as the "**Aouatif**" **Visual PROMETHEE** file that is installed together with the software.

The screenshot shows the 'Visual PROMETHEE Business - Aouatif.vpg (saved)' window. The interface includes a menu bar (File, Edit, Model, Control, PROMETHEE-GAIA, GDSS, GIS, Custom, Assistants, Snapshots, Options, Help) and a toolbar. The main area displays a table with columns for criteria and evaluation methods. The 'Aouatif' model is selected, and the 'Price' criterion is highlighted. The table shows various criteria like Unit, Cluster/Group, Preferences, Statistics, and Evaluations. The 'Evaluations' section shows results for different models: PromCalc, Decision Lab 2000, D-Sight, Smart-Picker Pro, Visual PROMETHEE, and DIY. The status bar at the bottom indicates 'Actions: 6 (6 active)', 'Criteria: 10 (10 active)', 'Scenarios: 1 (1 active)', 'Locale: Belgium [€/.]', and 'Saved'.

	Price	Scientific	Technical	Data	Analysis	Interface	Installation	Documentation	Localization	Evolution	
Unit	€	5-point	5-point	5-point	5-point	5-point	5-point	5-point	y/n	5-point	
Cluster/Group	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	
Preferences											
Min/Max	min	max	max	max	max	max	max	max	max	max	
Weight	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	
Preference Fn.	Linear	Usual	Usual	Usual	Usual	Usual	Usual	Usual	Usual	Usual	
Thresholds	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute	
- Q: Indifference	€ 10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
- P: Preference	€ 50	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
- S: Gaussian	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Statistics											
Minimum	€ 0	1,00	1,00	1,00	2,00	1,00	1,00	1,00	0,00	1,00	
Maximum	€ 249	5,00	4,00	5,00	5,00	5,00	5,00	5,00	1,00	5,00	
Average	€ 88	3,33	2,00	3,33	3,00	3,00	2,83	2,33	0,33	3,00	
Standard Dev.	€ 109	1,70	1,15	1,49	1,15	1,29	1,46	1,37	0,47	1,63	
Evaluations											
<input checked="" type="checkbox"/> PromCalc	●	€ 0	very good	very bad	very bad	average	very bad	very bad	very bad	no	very bad
<input checked="" type="checkbox"/> Decision Lab 2000	●	€ 0	very good	very bad	bad	good	good	very bad	average	no	very bad
<input checked="" type="checkbox"/> D-Sight	◆	€ 249	bad	good	very good	bad	average	good	bad	no	average
<input checked="" type="checkbox"/> Smart-Picker Pro	◆	€ 190	bad	bad	average	bad	average	average	bad	no	average
<input checked="" type="checkbox"/> Visual PROMETHEE	●	€ 0	very good	average	good	very good	very good	very good	very good	yes	very good
<input checked="" type="checkbox"/> DIY	■	n/a	very bad	very bad	very good	bad	bad	average	very bad	yes	very good

3. The analysis

Let us now start the analysis.

- **GAIA**

The **GAIA** analysis is usually a good starting point because it is descriptive and can help the decision-maker to better understand the decision problem. Here is the **GAIA** plane:



A first and important step is to verify the quality level of the **GAIA** plane. It is displayed at the bottom right of the [GAIA](#) window. In this case it is equal to 79.2% which is rather good.

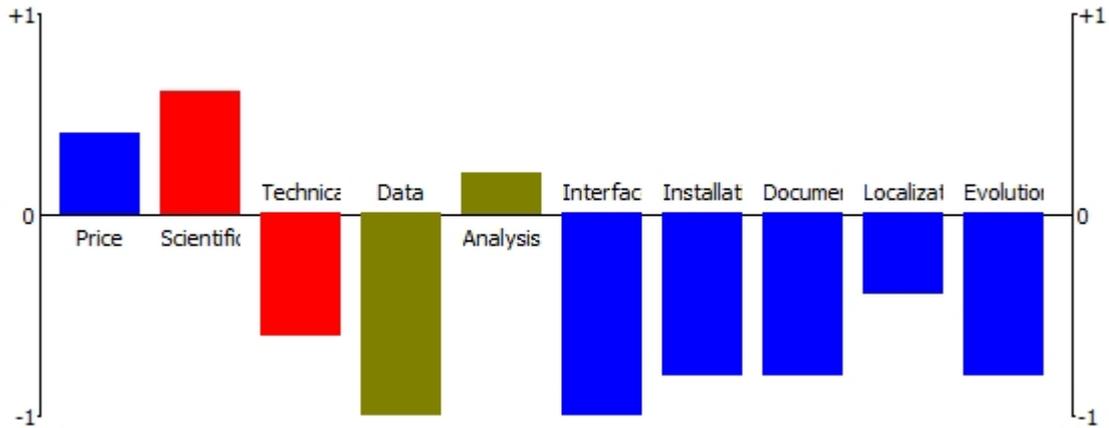
In the **GAIA** plane, the six software are relatively far away from each other with the exception of the two **Paid** software (red diamonds) that are closer to each other. This indicates that most software are quite different from each other. Let us try to explain these differences.

Looking at the criteria, each criterion is represented by an axis. Three groups are detected:

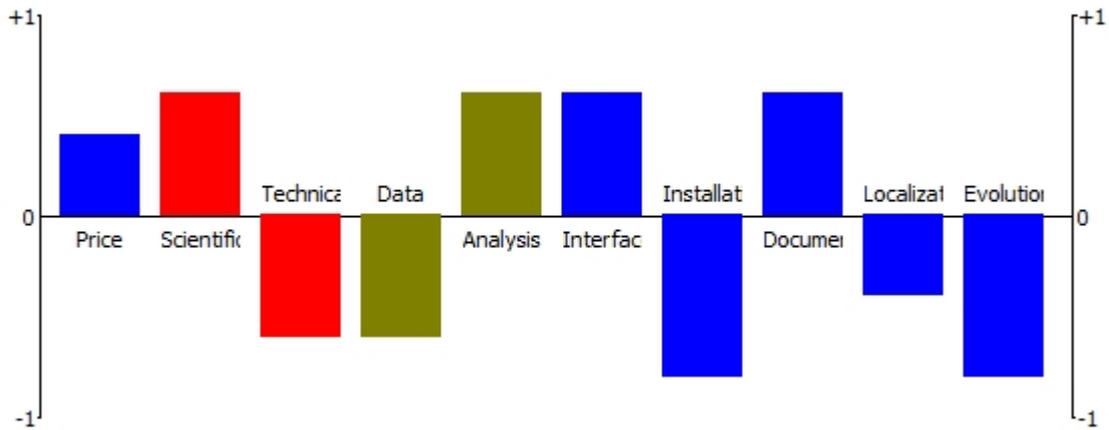
- **Price, Scientific and Analysis:** it is interesting to note that the the **Free** software (green circles) are also the ones with the best **Scientific** support and **Analysis** capabilities.
- **Technical, Data, Installation, Localization and Evolution:** These criteria are oriented towards the right. They separate the older software (on the left side) from the newer (on the right side).
- **Interface and Documentation:** These two criteria are in the middle with respect to the two previous groups. Clearly the best documentation and interface are those of **Visual PROMETHEE**.

Finally we can have a look at the [Action Profiles](#) or [GAIA Webs](#) of the different actions:

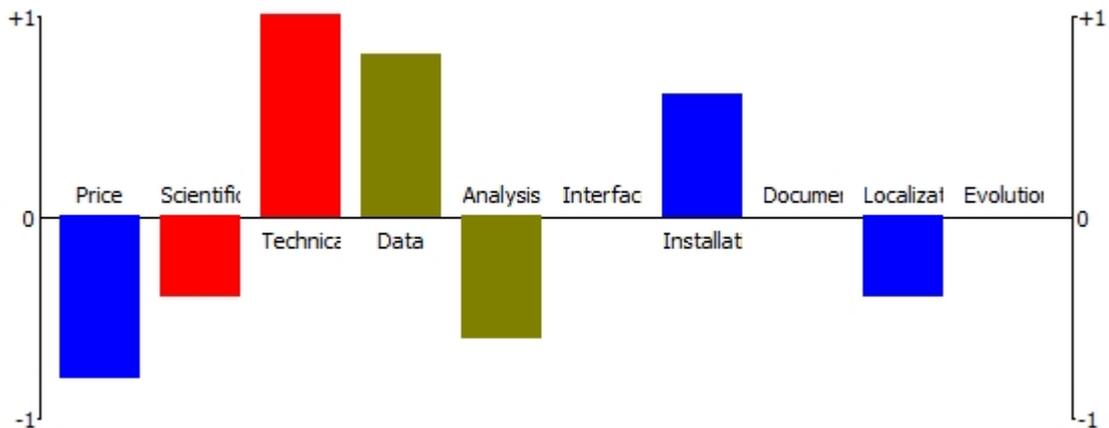
- **PromCalc:** Cheap solution, with a very good scientific background and decent analysis capabilities but very old.



- **Decision Lab 2000:** Better interface and documentation than **PromCalc** but still very old.

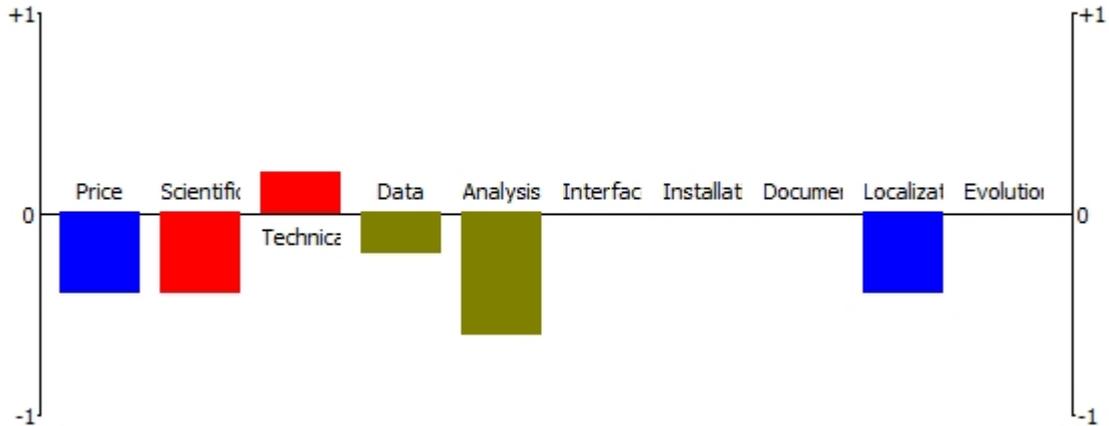


- **D-Sight:** Expensive and not backed by the scientific expertise of the authors of the **PROMETHEE** methods. Technically a good solution (support, data interface and hardware compatibility) even if a bit rough on the interface and weak with respect to documentation. Besides who knows what these guys will do next year?

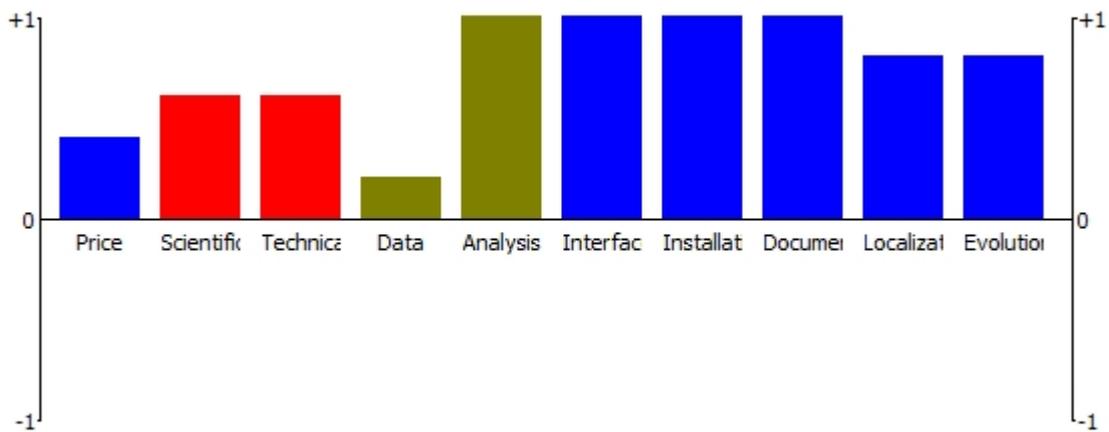


- **Smart-Picker Pro:** Similarly priced and scientifically backed as **D-Sight** it seems more limited with respect to functions. Besides nobody knows who manages the

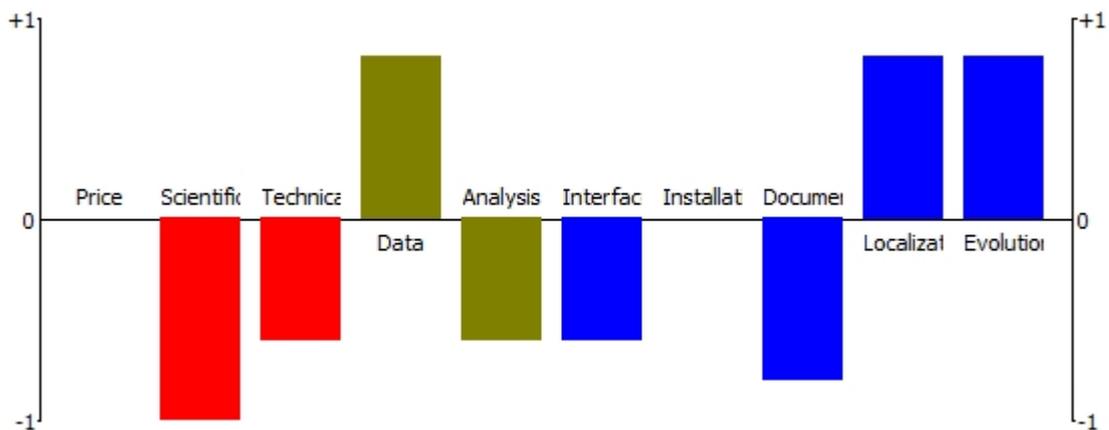
company or where it is located...



- Visual PROMETHEE:** Backed by the authors of the PROMETHEE methods, this one is the logical evolution of **PromCalc** and **Decision Lab 2000**. The interface is well polished, it includes several new developments, assistants, an extensive documentation, and it can be localized (currently available in five languages). It is also free for non-profit academic purposes.



- DIY:** The **Do It Yourself** alternative is interesting because it can be tailor-made and it is easy to adapt to future needs. But it is a lot of work and there is no scientific background available to check the results.



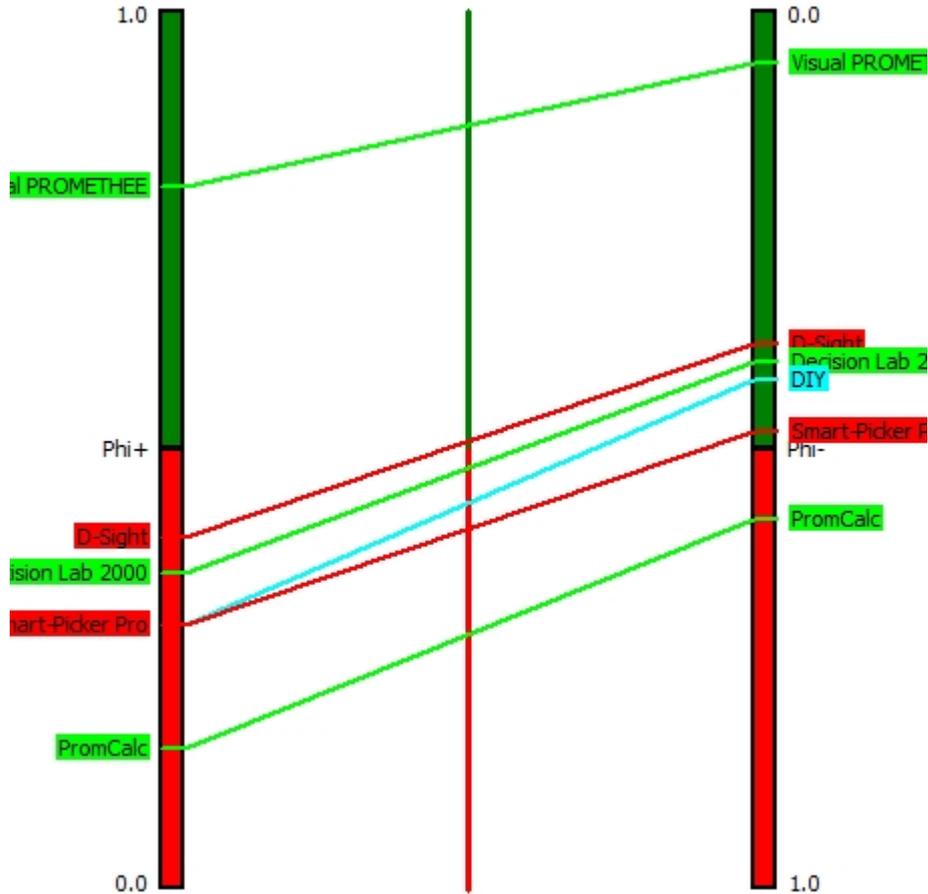
Looking at the position of the decision axis and the orientation of the criteria axes, the current weight distribution seems consistent with the objectives of Aouatif. However a weight sensitivity

analysis could be conducted to check the robustness of the **PROMETHEE** rankings.

○ **PROMETHEE Rankings**

The **PROMETHEE I** ranking shown below is rather clear. Three groups of software appear:

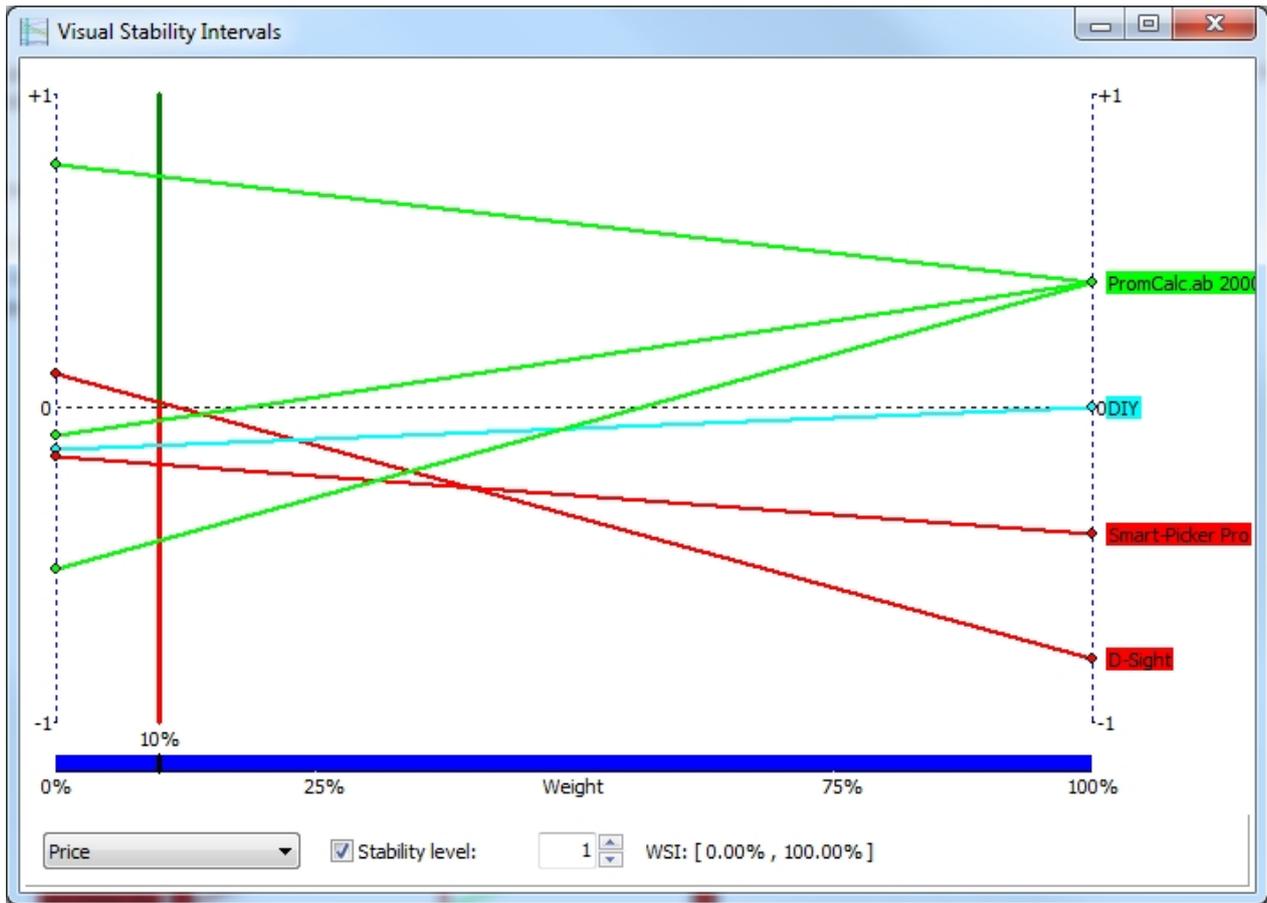
- At the top, **Visual PROMETHEE** dominates the others.
- In the middle, four software are very close to each other. There are no incomparabilities among them.
- At the bottom, **PromCalc** is dominated by all the others.



○ **Sensitivity Analysis**

Let us now check how much the **PROMETHEE** rankings are affected by the weights of the criteria. What if for instance more weight is given to the **Price** criterion?

The [Visual Stability Intervals](#) window can be used for this purpose. The screenshot below shows the display for criterion **Price**. It can be seen that **Visual PROMETHEE** is at the top of the **PROMETHEE II** ranking whatever the weight of the criterion is set to.



You can check that is the same for the following criteria: **Scientific, Analysis, Interface, Installation, Documentation, Localization and Evolution.**

For **Technical**, **Visual PROMETHEE** is a the top for weight values less than or equal to 67.86%. For larger weight values, **D-Sight** is first ranked and **Visual PROMETHEE** is second.

For **Data**, the weight has to be larger than 59% to see **D-Sight** and **DIY** at the top of the ranking.

Globally **Visual PROMETHEE** stays at the top of the ranking except for some very uneven weight distributions where most weight is allocated to **Technical** or to **Data**.

4. The conclusion

What do you think?

What software would you be using if you were Aouatif?

How to analyze your own problem

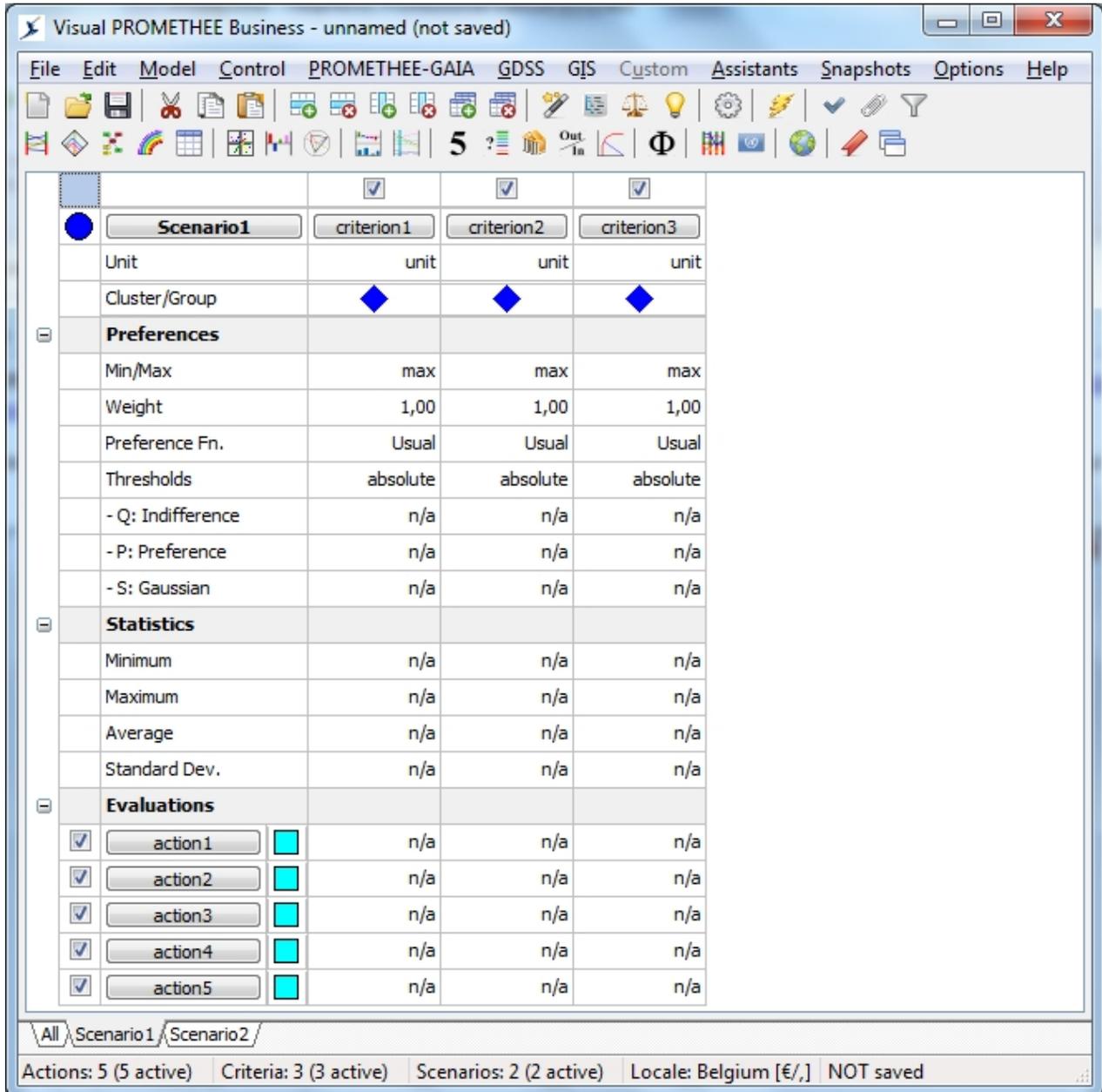
This section contains more detailed explanations about how to manage activities with **Visual PROMETHEE**:

- [Define a new problem](#)
 - [Define the actions](#)
 - [Define the criteria](#)
 - [Define the scenarios](#)
 - [Model preferences](#)
 - [Organize the criteria](#)
 - [Weigh the criteria](#)
- [Rank different actions](#)
- [Use the GAIA analysis](#)
- [Perform a sensitivity analysis](#)
- [Use weight presets](#)
- [Generate a report](#)

Define a new problem

To define a new problem in **Visual PROMETHEE**, first use the "File | New..." command to generate a new empty spreadsheet. The [Create a new problem](#) dialog allows you to specify the number of [actions](#), [criteria](#) and [scenarios](#) that should be included in the new problem. These can be adjusted later if necessary.

The following screenshot shows a newly created problem with five actions, three criteria and two scenarios. As it can be seen default names and data have been automatically generated.



The following steps should then be performed in order to properly model the problem:

1. [Define the actions](#)
2. [Define the criteria](#)
3. [Define the scenarios](#)
4. [Model preferences](#)
5. [Organize the criteria](#)
6. [Weigh the criteria](#)

Define the actions

Click on the name of an action or select "**Model | Actions...**" to open the [Actions](#) dialog and select the [action](#) you want to modify in the **Select** drop-down list. This dialog allows to change the properties of the actions.

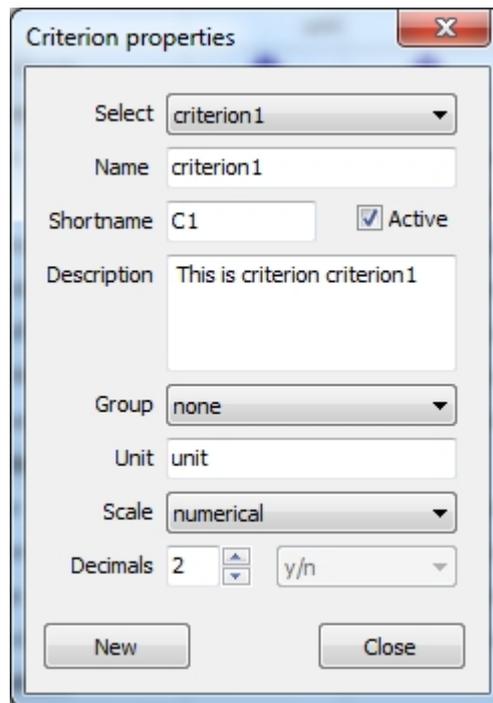
The following information should be defined for each action in the decision problem:

- Name: the name of the action.
- Shortname: a shorter name that can be displayed to reduce the clutter on some graphics when there are many actions.
- Active: only active actions are considered in the computation of the results. Uncheck the box if the action should not be considered in the computation.
- Description: a text giving a more detailed description of the action.
- Category: each action belongs to a [category](#) (the default category is named **none**). This is useful to visually identify actions according to specific attributes (geographical location, nationality, technology, ...) as each category can be associated to a specific shape and specific colors. The action category can be selected in the drop-down list. New categories can be created using the "Model | Action Categories..." command (see the [Action Categories](#) dialog).
- Location: For geo-localized data, it is possible to associate a map location to each action. Click on the **Location** button to open the [Location](#) dialog and set the geographical coordinates of the action.

From this dialog you can also add a new action or delete the currently selected one.

Define the criteria

Click on the name of a criterion or select "**Model | Criteria...**" to open the [Criteria](#) dialog and select the [criterion](#) you want to modify in the **Select** drop-down list. This dialog allows to change the properties of the criteria.



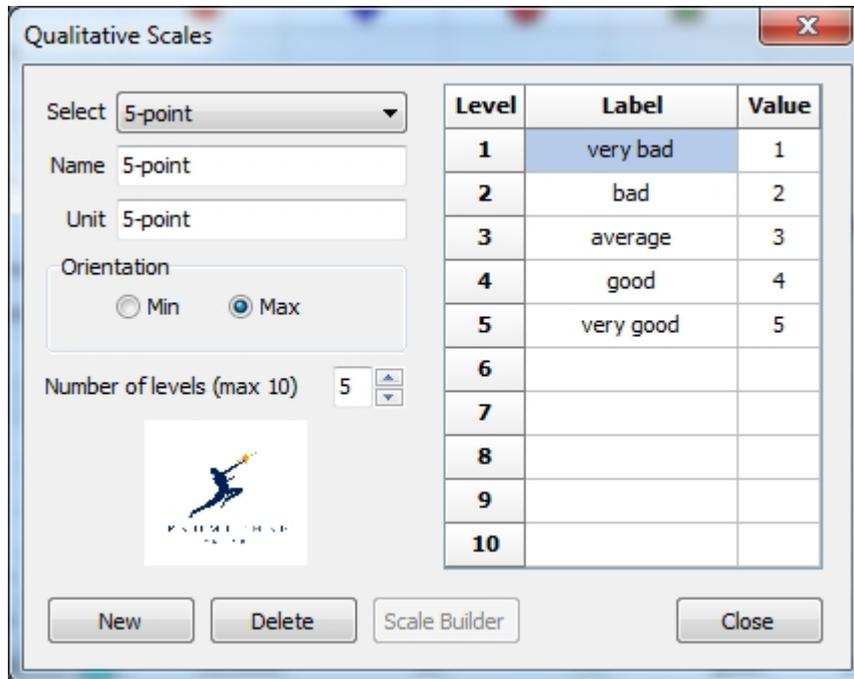
The following information should be defined for each criterion in the decision problem:

- Name: the name of the criterion.
- Shortname: a shorter name that can be displayed to reduce the clutter on some graphics when there are many criteria.
- Active: only active criteria are considered in the computation of the results. Uncheck the box if the criterion should not be considered in the computation.
- Description: a text giving a more detailed description of the criterion.
- Group: each criterion belongs to a [group](#) (the default group is named **none**) and each group belongs to a [cluster](#). This is useful to visually identify criteria that are linked to each other (such as for instance financial, technical, environmental or social criteria) within the Visual PROMETHEE criteria [hierarchy](#) with specific shapes and colors. The criterion group can be selected in the drop-down list. New groups can be created using the "Model | Criteria Groups..." command (see the [Criteria Groups](#) dialog).
- Unit: this is the name of the criterion unit.
- Scale: The drop-down list allows to select one of three possible scale type:
 - numerical: this is for quantitative criteria expressed on a numerical scale, evaluations will be displayed as numbers.
 - currency: this is for money! Evaluations will be displayed as the currency specified in the [localization](#) options,
 - qualitative: qualitative criteria can be evaluated on a [qualitative scale](#), select the name of the scale in the drop-down list below. Qualitative scales can be [defined](#) using the [Qualitative Scales](#) dialog.
- Decimals: the number of decimal places displayed for the criterion.

From this dialog you can also add a new criterion.

Define qualitative scales

To define qualitative scales you can use the "**Model | Qualitative Scales...**" command and open the [Qualitative Scales](#) dialog.



From this window you can:

- Select one of the four predefined scales (yes/no, impact, 5-point or 9-point).
- Define a new qualitative scale:
 - Click the "New" button.
 - Give a name and a unit name to the new scale.
 - Set the number of levels (max. 10).
 - Define the levels and the associated values.
 - Define whether the scale values have to be minimized or maximized.

Define the scenarios

Visual PROMETHEE allows to define several [scenarios](#) for a given decision problem.

All the scenarios share:

- The set of actions, and action categories.
- The set of criteria, criteria groups and clusters.
- The qualitative scales.

The scenarios include specific values for:

- The evaluations of the actions.
- The criteria preference structures, including the preference functions and the weights.

Scenarios can be used to represent:

- Several points of view: each scenario corresponds to one stakeholder and incorporates his//her perceptions and preferences.
- Several hypotheses: such as for instance different forecasts for future or expected values.
- Several time periods.
- ...

Click on the name of the current scenario (at the top left of the spreadsheet) or select "**Model | Scenarios...**" to open the [Scenarios](#) dialog and select the [scenario](#) you want to modify in the **Select** drop-down list. This dialog allows to change the properties of the scenarios.

The following information should be defined for each scenario in the decision problem:

- Name: the name of the scenario.
- Shortname: a shorter name that can be displayed to reduce the clutter on some graphics when there are many scenarios.
- Active: only active scenarios are considered in the computation of the results. Uncheck the box if the scenario should not be considered in the computation.
- Description: a text giving a more detailed description of the scenario.
- Weight: relative weight of the scenario.
- Coalition: the [coalition](#) to which the scenario belongs.

From this dialog you can also add a new scenario or delete the currently selected one.

New scenarios can be added by:

- Clicking on the **New** button in the [Scenarios](#) dialog.
- Clicking the "Add scenario" button in the main window [toolbar](#).
- Selecting "Edit | Duplicate Scenario" in the [Main Menu](#) to duplicate the current scenario.

Model preferences

Once the set of [actions](#) and the set of [criteria](#) have been defined it is important to model preferences.

This is done in two steps with **Visual PROMETHEE**:

1. A [preference function](#) has to be associated to each criterion.
2. The criteria have to be [weighed](#) according to the [decision-maker](#) priorities.

This has to be done separately for each [scenario](#).

Preference functions

Six different types of [preference function](#) are available in **Visual PROMETHEE**.

Use the [Preference Function Assistant](#) to get advice on the best choice.

Weights

[Weights](#) have to be allocated to the criteria in order to reflect their relative importance for the decision maker.

When the number of criteria is large, it can be more difficult to allocate the weights. In such cases however criteria can often be [organized hierarchically](#) into [clusters](#) and [groups](#). This makes it easier to allocate the weights and to ensure that no bias is induced by the number of criteria.

Use the [Weighing Assistant](#) to help you allocating weights.

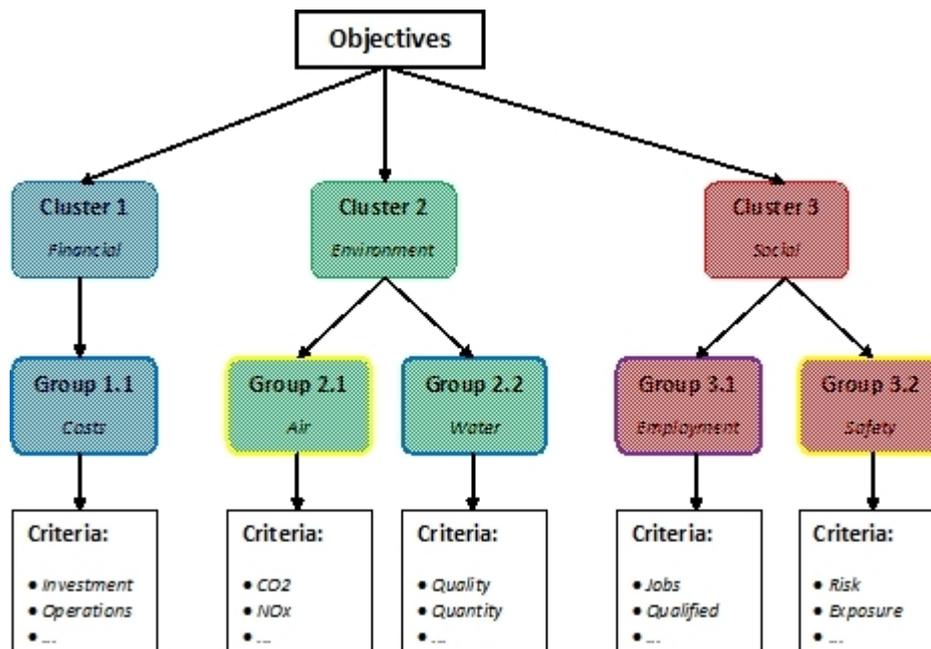
Organize the criteria

Visual PROMETHEE allows to organize criteria into a three-level hierarchy. This is especially useful when the number of criteria is large. In such cases criteria can usually be grouped according to higher level objectives.

For instance in a context of sustainable development three higher objectives can be identified:

- Financial: criteria that measure the financial impact of the decisions.
- Environment: criteria that measure the environmental impacts of the decisions.
- Social: criteria that measure the social impacts of the decisions.

In **Visual PROMETHEE** these can be associated to [clusters](#) of criteria. This is the higher level of the hierarchy.



Within each cluster, several sub-groups of criteria can often be defined. For instance in the Environment cluster of criteria, the following [criteria groups](#) could be defined:

- Air: environmental impacts linked to the air quality.
- Water: environmental impacts linked to the water quality or availability.

This is the intermediate level of the hierarchy.

At the bottom level are the individual criteria:

- Each individual criterion belongs to one group.
- Each group belongs to one cluster.

In **Visual PROMETHEE** clusters and criteria groups are identified by colors:

- Each cluster is identified by a shape and background color.
- Each criteria group is identified by an outline color.

Clusters and criteria groups can also be analyzed as a whole using their **Grouped** property. This makes sensitivity analyses much easier.

The [Weighing Assistant](#) allows to allocate hierarchically the weights to the criteria.

Weigh the criteria

[Weights](#) have to be allocated to the criteria in order to reflect their relative importance for the decision maker.

Assessing weights to the criteria is not always straightforward. It involves the priorities and perceptions of the

decision-maker. The weights also represent his/her space of freedom. **Visual PROMETHEE** includes several [sensitivity analysis](#) tools to help the decision-maker in that task.

You can also use the [Weighing Assistant](#) to help you allocating weights.



The U-shape preference function introduces the notion of an indifference threshold.

Type III: V-shape preference function



The V-shape preference function is a special case of the Linear preference function where the Q indifference threshold is equal to 0. It is thus well suited to quantitative criteria when even small deviations should be accounted for.

Type IV: Level preference function



The Level preference function is better suited to qualitative criteria when the decision-maker wants to modulate the preference degree according to the deviation between evaluation levels.

Type V: Linear preference function



The Linear preference is the best choice for quantitative criteria when a Q indifference threshold is wished.

Type VI: Gaussian preference function



The Gaussian preference function is an alternative to the Linear one. It has a smoother shape but it is more difficult to set up because it relies to a single S threshold that is between the Q and P thresholds and has a less obvious interpretation. It is seldom used.

Q, P and S thresholds

Depending on the type of preference function that has been selected up to two thresholds have to be assessed. These are:

- Q - the indifference threshold
- P- the preference threshold
- S - the Gaussian threshold

Q: Indifference threshold

The Q indifference threshold is the largest deviation that is considered as negligible by the decision-maker. To determine the value of Q one should start with a very small deviation (for instance a few Euros) and increase it progressively until it is not felt to be negligible anymore. This means that Q is just below that first

significant value.

P: Preference threshold

The P preference threshold is the smallest deviation that is considered as sufficient to generate a full preference.

To determine the value of P one should start with a very large deviation (for instance several thousands euros) and progressively reduce it until some hesitation arises. This means that P is slightly above this last value.

S: Gaussian threshold

The S Gaussian threshold correspond to the inflection point of the Gaussian curve (similarly to the standard deviation in statistics). It is thus a deviation for which the preference degree is equal to 0.39 so it is in between a Q and a P value. It is also more difficult to assess. A rule of thumb could be to determine a Q and a P value and to set S equal to their average ($S = (Q+P) / 2$).

Rank different actions

Once the [actions](#) and [criteria](#) have been [defined](#) and the preference parameters (preference functions and weights) have been [set](#), it is possible to rank the actions using the **PROMETHEE** method.

PROMETHEE Rankings

Click "**PROMETHEE-GAIA | PROMETHEE Rankings**" to open the **PROMETHEE Rankings** window.

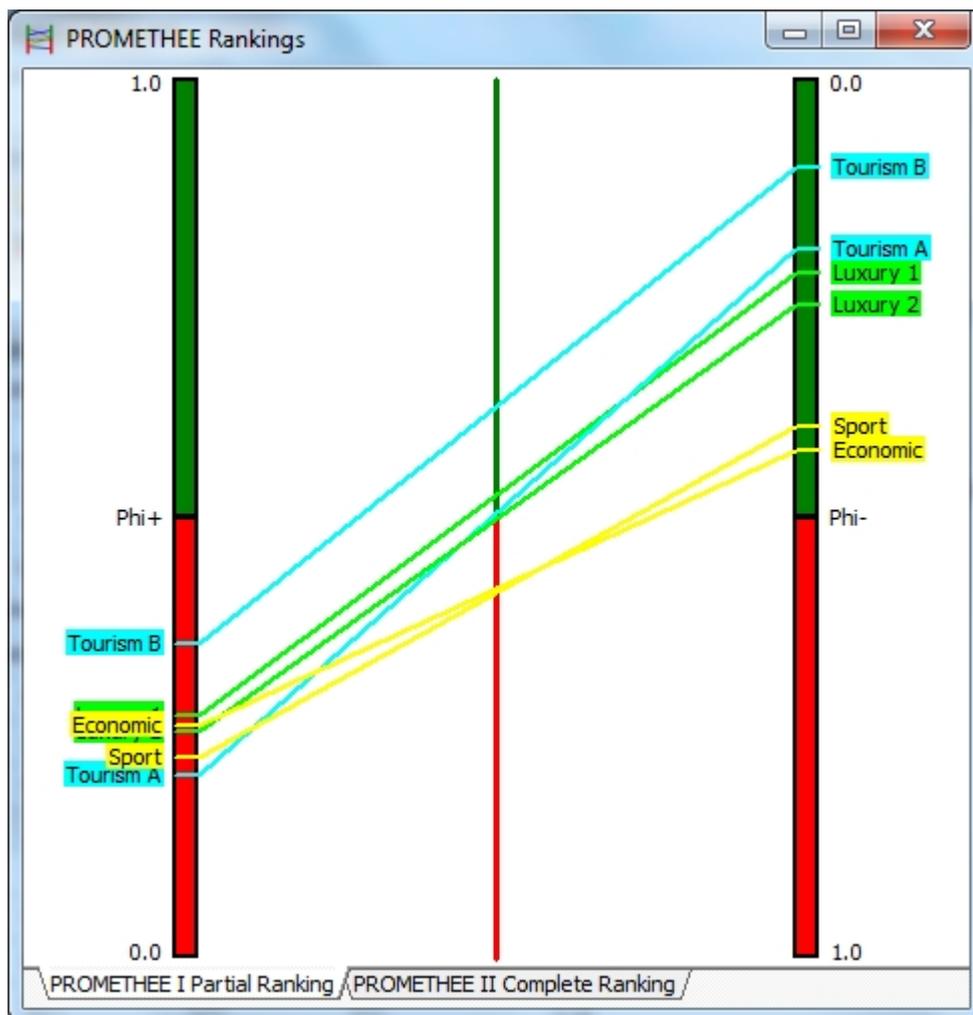
There are two tabs at the bottom of the window:

- [PROMETHEE I Partial Ranking](#)
- [PROMETHEE II Complete Ranking](#)

PROMETHEE I Partial Ranking

The [PROMETHEE I Partial Ranking](#) is based on the computation of two [preference flows](#):

- **Phi+** (positive or leaving flow) is a measure of strength. It is represented on the left-side bar with the best (largest) values in green at the top of the bar and the worst in red at the bottom.
- **Phi-** (negative or entering flow) is a measure of weakness. It is represented on the right-side bar with the best (smallest) values in green at the top of the bar and the worst in red at the bottom.



Both **Phi+** and **Phi-** can be used to rank the actions. However they don't always provide exactly the same ranking. Indeed because of the conflicting aspect of a multicriteria problem it is not always easy to compare two actions: one can be much better on one subset of criteria and the other can be much better on another

subset of criteria. In such cases and according to the preference parameters defined by the decision-maker different ways of evaluation (such as **Phi+** and **Phi-**) can lead to different rankings.

PROMETHEE I tries to be prudent in such cases: it compares the two rankings induced by **Phi+** and **Phi-** and only includes preferences that are confirmed by both rankings. Consequently it is only a partial ranking: when the two flow rankings conflict with each other no comparison is made ([incomparability](#)). This can be useful as it shows the decision-maker what are the most difficult comparisons.

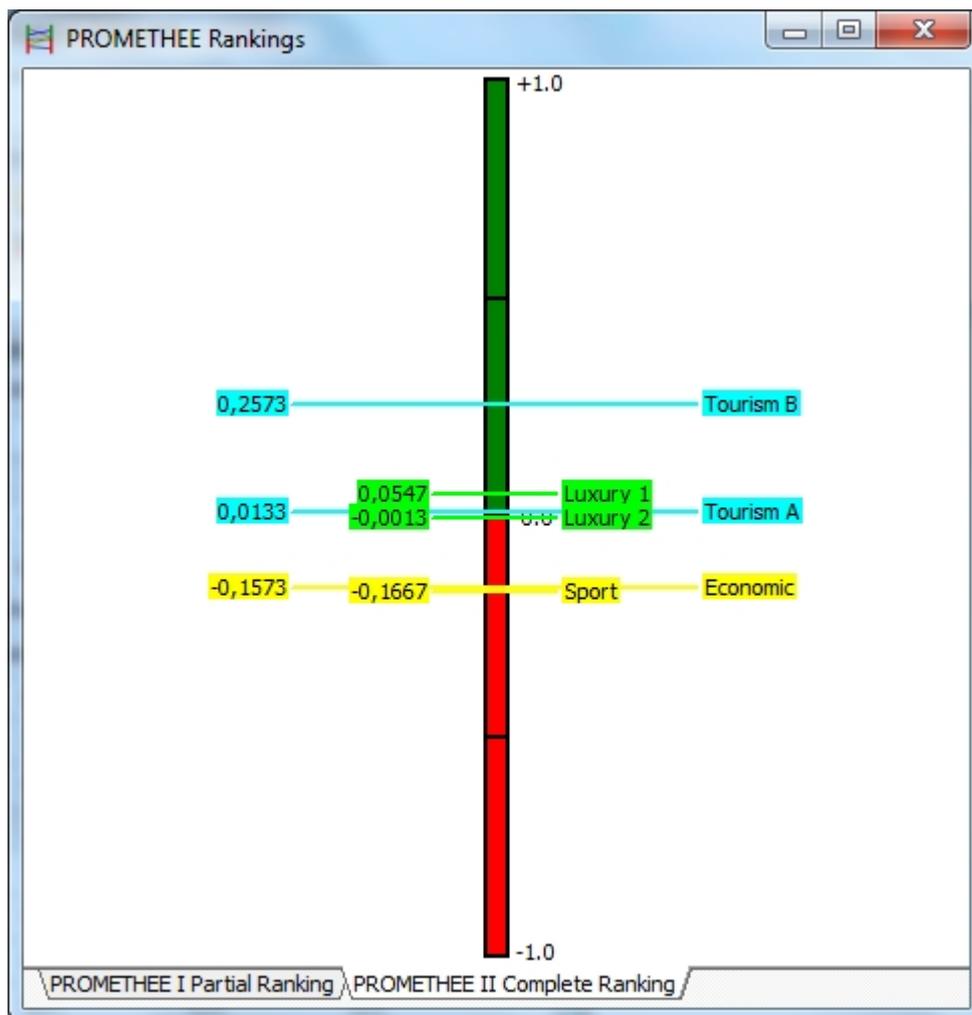
In **Visual PROMETHEE** the **PROMETHEE I** partial ranking is displayed by drawing a line for each action between its **Phi+** score on the left vertical bar and its **Phi-** score on the right vertical bar. When a line is on top of another it means that the action is preferred to the other. When two lines are crossing each other it means that the actions are incomparable in **PROMETHEE I**.

In the above example we see that **Tourism B** is preferred to all the other actions. The **Sport** car is incomparable with the **Economic** one. And **Tourism B** is incomparable with all the other actions (except **Tourism B**).

The way the display is organized the middle vertical bar actually shows to the **Phi** net flow scores of the actions and thus displays the **PROMETHEE II Complete Ranking** that is discussed in the next section.

PROMETHEE II Complete Ranking

The [PROMETHEE II Complete Ranking](#) is based on the **Phi** net flow which is the balance (difference) between **Phi+** and **Phi-**. The **Phi** score can be negative: it is a number in the -1 to +1 range. The **PROMETHEE Rankings** window displays the **Phi** scores on a vertical bar.



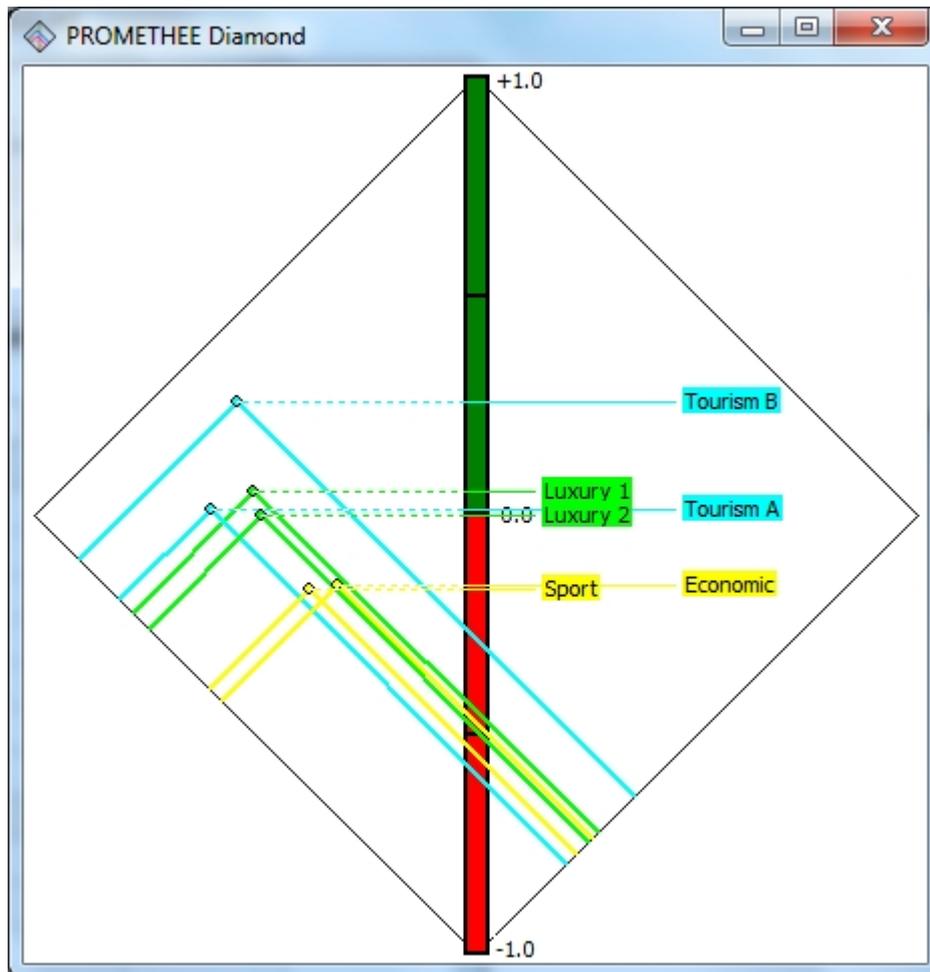
In the above example, three groups of actions are easily identified:

- **Tourism B** at the top.
- **Luxury 1, Luxury 2** and **Tourism A** in the middle.
- **Sport** and **Economic** at the bottom.

It should be noted that as the **PROMETHEE II** Complete Ranking doesn't include any incomparabilities it is thus less prudent than the **PROMETHEE I** Partial Ranking.

PROMETHEE Diamond

The [PROMETHEE Diamond](#) is an alternate view of the **PROMETHEE** Rankings.



The 45°-angled square corresponds to the $(\Phi^+; \Phi^-)$ plane oriented in such a way that the vertical axis gives the Φ score.

Each action is represented by a cone. The top of the cone is located at the $(\Phi^+; \Phi^-)$ coordinates of the action.

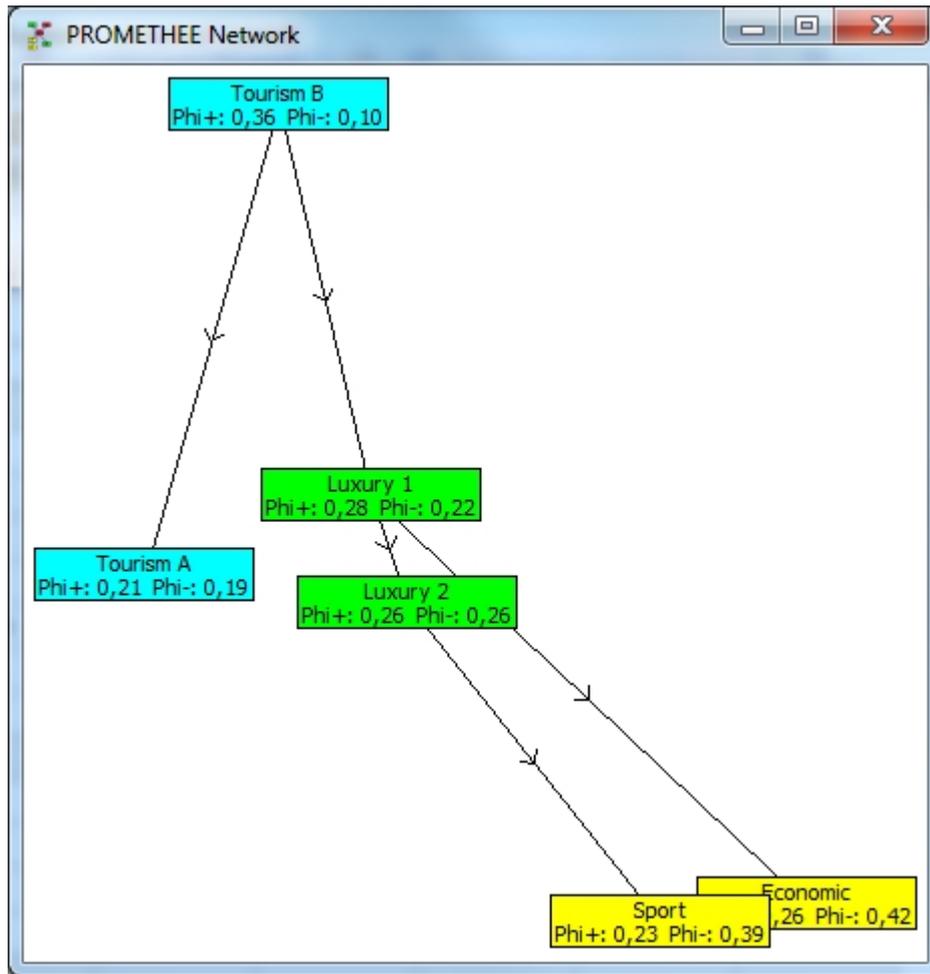
When a cone overlaps another one it corresponds to a preference. When two cones intersect each other there is an incomparability in the **PROMETHEE II** Partial Ranking.

In this example the three groups of actions are very easy to distinguish from each other.

PROMETHEE Network

Click "**PROMETHEE-GAIA | PROMETHEE Network**" to open this window.

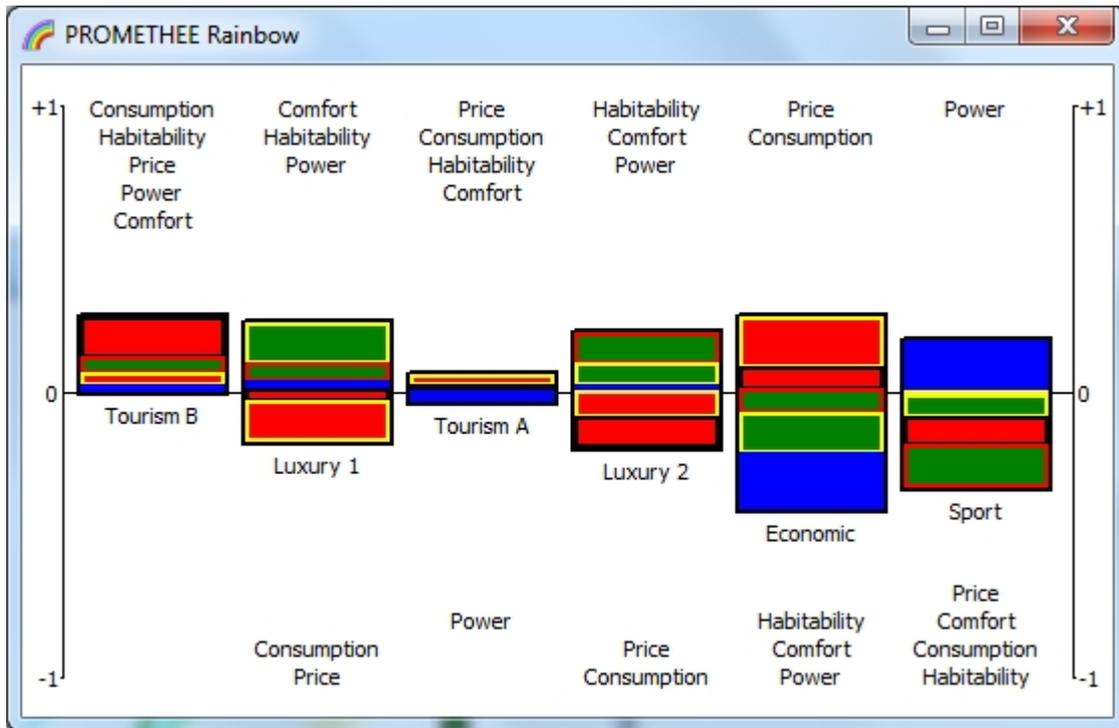
The [PROMETHEE Network](#) representation of the **PROMETHEE I** Partial Ranking will feel familiar to the users of older **PROMETHEE** software such as **PromCalc** or **Decision Lab**. Actions are represented by nodes and arrows are drawn to indicate preferences. Incomparabilities are thus very easy to detect.



Visual PROMETHEE uses an enhanced network representation: instead of drawing the nodes at arbitrary locations the relative positions of the actions in the **PROMETHEE Diamond** are used. The network representation is like a close-up of the **Diamond** view where preferences are indicated by arrows. This makes it very straightforward to appreciate the proximity between actions and thus the degrees of incomparability in the partial ranking.

PROMETHEE Rainbow

The [PROMETHEE Rainbow](#) is a disaggregated view of the **PROMETHEE II** Complete Ranking.



For each action a bar is drawn with as many slices as the number of criteria. Each slice corresponds to the contribution of the criterion to the **Phi** net flow score of the action taking into account the weight of the criterion. This way the sum of the positive slices minus the sum of the negative ones is equal to the **Phi** net flow score of the action.

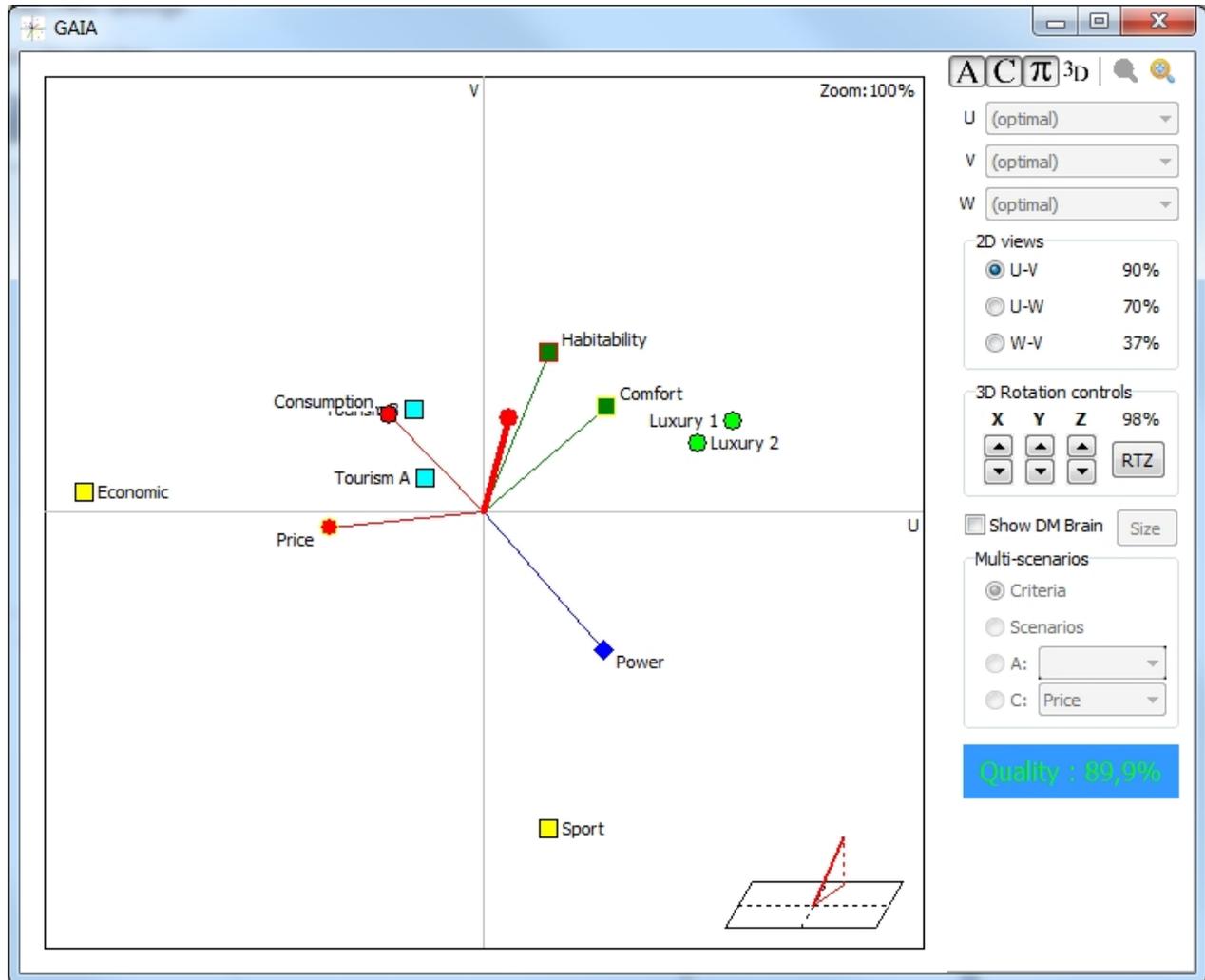
In the above example it appears that:

- **Tourism B** has no negative contributions to its **Phi** score. It has no weaknesses compared to the other actions.
- While **Luxury 1**, **Tourism A** and **Luxury 2** have **Phi** scores that are very close to each other, the **Tourism A** car appears to be quite different from the two other ones: its bar is very short which means that it has a very average profile. The two other cars have larger bars with positive and negative slices: they are better on some criteria and worse on others.
- The **Economic** car has a very large bar: it is very good on some criteria (**Price** and **Consumption**) and very bad on others (**Habitability**, **Comfort** and **Power**).

Use the GAIA analysis

The [GAIA](#) analysis is a descriptive complement to the **PROMETHEE** rankings.

Click "**PROMETHEE-GAIA | GAIA Visual Analysis**" to open the [GAIA](#) window.



Detailed information about using **GAIA** can be found in the user manual.

Perform a sensitivity analysis

It is important to keep mind that decision aid models such as the one used in the **PROMETHEE** and **GAIA** methods rely on different assumptions that make it possible to analyze the [decision problem](#) and to provide the [decision-maker](#) with sound advice.

In particular the **PROMETHEE** methodology rely on the definition of [preference functions](#) and [weights](#) to model the preferences and priorities of the decision-maker.

Visual PROMETHEE has been conceived to make this important modeling step as easy as possible:

- Most important data are centralized and can be modified directly in a spreadsheet-like table in the [main window](#).
- The [Preference Function Assistant](#) is available to guide the choice of the preference functions.
- The [Weighing Assistant](#) and the [Criteria Hierarchy Assistant](#) can be used to organize the criteria and to allocate the weights.

While empirical studies have shown that the **PROMETHEE** method is rather robust with respect to the values of the preference function thresholds, the weights of the criteria usually have a strong impact on the results of the analysis, especially when there are strongly conflicting criteria.

Performing a weight sensitivity analysis is thus essential and **Visual PROMETHEE** includes several tools to facilitate this type of sensitivity analyses:

- [Actions](#), [categories](#), [criteria](#), [groups](#), [clusters](#), [scenarios](#) and [coalitions](#) can be temporarily deactivated using the [Activation Center](#) window to test or to compare easily different model configurations. Actions and Criteria can even be deactivated directly from the main window using intuitive checkboxes.
- The [Walking Weights](#) window can be used to interactively modify the weights. All the computations are continuously adjusted and the contents of the opened windows are updated as well.
- The [Visual Stability Intervals](#) window provides the user with a more exhaustive weight sensitivity analysis: it shows how the **Phi** score and the **PROMETHEE II** ranking vary as a function of the weight of a criterion and identifies the interval of stability of the top ranked actions.
- The [Decision Maker Brain](#) visualization in the [GAIA](#) window shows the degree of difficulty of the decision problem according to the robustness of the **PROMETHEE II** ranking to weight variations.
- The possibility to define multiple scenarios for a same decision problem can be used to compare different points of view in a group decision context ([GDSS](#)). It can also be useful to compare different hypotheses, for instance when the evaluation of some criteria relies on forecasts or is imprecise.
- The [Balance of Power](#) window is similar to the [Walking Weights](#) but allows for changing the weights of the scenarios.

Generate a report

The data and the results of the analysis can be exported from **Visual PROMETHEE** in different ways to support reporting:

- Most windows include a [local menu](#) with a "**Copy**" item that can be used to copy the window's content to the clipboard. Most graphical output can thus be pasted directly into other applications such as word processors or presentation software.
- The "**File | Export...**" menu item can be used to [export](#) data and numerical results to a text file that can be imported in a spreadsheet software.
- The [Report Generator](#) ("**File | Report...**") produces a tailor-made report with multiple user-selectable sections. Reports can be generated in **HTML**, **PDF** or **XLS(X)** format.

Useful links

You can find additional information at:

- www.promethee-gaia.net
This is the official **PROMETHEE-GAIA** web site. Here you can find and exchange information related to the methods and their implementation:
 - blog.promethee-gaia.net
The **PROMETHEE Blog** with information about events related to the methods and the software.
 - forum.promethee-gaia.net
The **PROMETHEE-GAIA Forum** where people can exchange information and experience related to the methods, the software and their applications.
 - faq.promethee-gaia.net
The **PROMETHEE-GAIA FAQ** with questions and answers related to the methods and the software.
 - biblio.promethee-gaia.net
The **Bibliographical Database** with over 500 scientific references related to the **PROMETHEE** methods.
- www.decision-drive.com
This is the site dedicated to the business applications of the **PROMETHEE** methods.
- www.sustainable-decisions.com
This site is dedicated to the use of multicriteria methods in the context of sustainable development.
- The **LinkedIn** [PROMETHEE Decision Aid Methods group](#)
- **Twitter** at @bmaresc
- ResearchGate at Bertrand Mareschal