TETRA QUICKSTART GUIDE

The purpose of this document is to give the reader an overview of the steps involved in using the Tetra decision making software to evaluate choices using preference function modelling. Tetra comes in two versions: One of which is used by a single decision maker (SDM). It is 'standalone,' in that everything is installed on a single computer, and all model information is stored in documents on that computer. The other is for group decision making (GDM). It is based on the use of a Tetra server, and all model information is stored on the server, allowing it to be accessed by users running Tetra on multiple workstations on a network. As the use of both versions is identical in many respects, this document covers both versions, pointing out the differences where appropriate.

You will see how to use Tetra to evaluate a number of alternatives, based on criteria organized in a hierarchical manner. The alternatives are rated on each of the criteria. In the case of SDM a single evaluator specifies his or her ratings. With GDM multiple decision makers can participate in the process.

The process of using Tetra to make a decision consists of eight steps:

1. Create a model.
2. Define the Decision Makers who will be involved in the process (GDM only).
3. Define the alternatives to be considered in making the decision.
4. Define the criteria upon which the decision will be based. These criteria may be defined in a tree-like structure, using main criteria, sub-criteria, sub-sub-criteria and so on.
5. Define the weights for all the criteria. These are defined relatively, specifying how important each criterion is in relation to others. The weights are defined in each node of the criteria tree.
6. Establish reference alternatives for each criterion.
7. Each Decision Maker enters his or her ratings for each alternative with respect to each criterion.
8. "Solve" the model that has been created by the previous steps to compute the overall scores and get a numerical rating of the alternatives that corresponds to the combined ratings of all of the Decision Makers.

Example: Buying a house

For Tetra SDM begin with Step 3.

Step 1 — Creating and Opening a Model (Tetra GDM Only)

In Tetra GDM, models are created on a server, and each client is set up for access to the server using the Tetra GDM Administration Tool. Information on creating models is contained in the on-line help for the Tetra GDM Administration Tool. Once a model has been created, and your computer is set up to access the Tetra server, you will need the following information to access the model:

- The server on which the model is located
- The name of the model
- Your personal username and password for the model

Choose Open Model... under the File menu, and provide the necessary information.

Step 2 — Defining Decision Makers (Tetra GDM Only)

In Tetra GDM the Model Owner specifies other users who can access the model. To do this, open the model as described above, and then choose Edit Decision Makers... under the Model menu or click the  icon on the toolbar. There are three different types of access that can be provided to models:

- Model Owner: This user is created in the process of creating the model using the Tetra GDM Administration Tool. The Model Owner is the only user who can define and modify the model. Like Decision Makers, the Model Owner can also specify ratings. The Model Owner is also responsible for defining the other users who have access to the model.
- Decision Maker: These users can view a model and specify their ratings for the alternatives based on the criteria defined. They cannot see weights or the ratings of other Decision Makers.
- Read Only: This type of user can only view the alternatives and criteria of the model, and cannot make any changes, specify or view any weights, or specify ratings. If this user was a Decision Maker at some time in the past, and specified ratings then, these ratings would still be visible to the user, but they would not be editable.

  There are two primary uses of Read Only users. The simplest is when you want to have a user who can view the alternatives and criteria, but who will not be providing ratings for the decision making process. In this case, be sure to set the weight of the user to zero. Another use for Read Only users is to "freeze" the ratings of a Decision Maker. To do this, the Model Owner can choose Edit Decision Makers... under the Model menu, select the desired Decision Maker, and then change the type of a Decision Maker user to Read Only. In this case you should leave the weight of the user as is, and not change it to zero, as doing so would remove that user's ratings from the computation of the model solution.

You should work through this guide initially as the Model Owner, with no additional Decision Makers defined. Once you have completed this guide, create at least one Decision Maker, and one Read Only user, then close the model and reopen it as each of these users to explore the differences in access privileges. Once the model has been defined, if you are

accessing the model as a Decision Maker skip to Step 7. If you are a Read Only user, you can simply browse the model, using the on-line help if necessary.

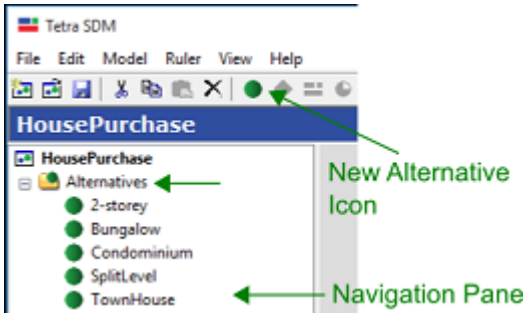
Step 3 — Identify Alternatives

Remember that, in Tetra GDM, you must be the Model Owner in order to perform this step.

Suppose you have narrowed the choice to 5 acceptable homes: a bungalow, a split-level, a 2-storey house, a townhouse and a condominium.

Tetra actions to create alternatives:

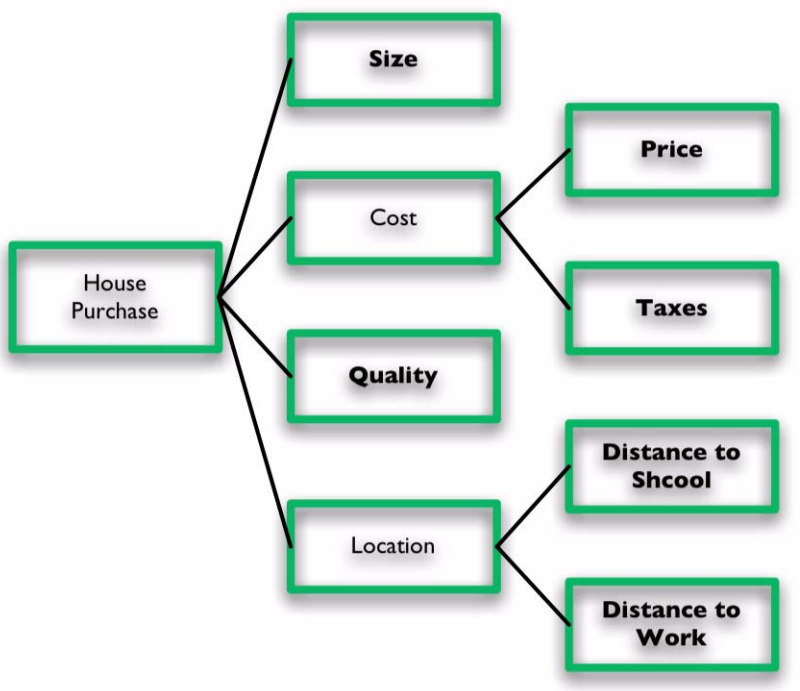
- Right-click on the word Alternatives in the Navigation Pane and Select New Alternative (or click on the New Alternative icon ● in the toolbar) once for each of your five alternatives, and name the five houses accordingly.



Step 4 — Define Criteria

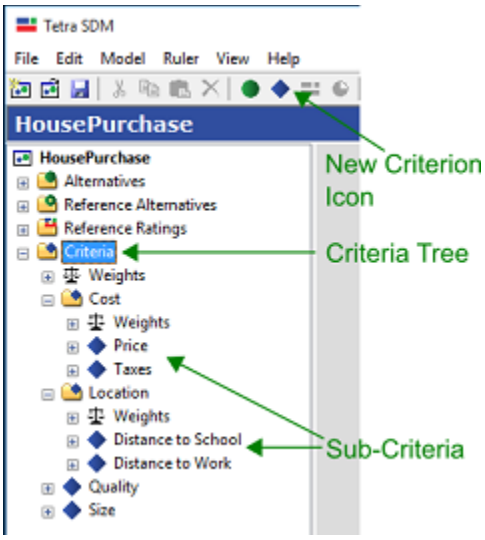
Remember that, in Tetra GDM, you must be the Model Owner in order to perform this step.

Assume that house Size, Cost, Quality and Location are your main criteria for making the decision. Furthermore, assume that your preference for the location actually depends on two sub-criteria: Distance to Work, and Distance to School for the children. Also, with respect to cost, you realize that you are concerned with the Taxes as well as the purchase Price (two more sub-criteria). The evaluation criteria are shown here.



The method requires that you only state your ratings for the last level of sub-criteria on any branch, in this case the six bolded criteria.

Tetra actions to create criteria:



- Right click on the word Criteria in the criteria tree and select New Criterion (or click on the new criterion icon ◆ in the toolbar) once for each of your four main criteria, and name them accordingly.

Tetra actions to create sub-criteria:

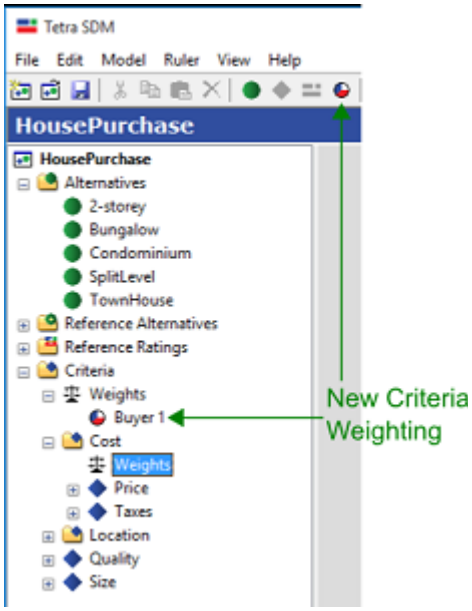
- Select a criterion (such as Cost) in the criteria tree for which you want to enter sub-criteria, and now when you right click on it and select New Criterion (or click on the new criterion icon ◆) new branches are created under the selected criterion. Observe that, when you define a sub-criteria, the icon of the criterion you create it below is changed from a simple criterion icon to a criteria folder icon 📁.
- Repeat this process for all sub-criteria. Create price and taxes sub-criteria for the cost part of the hierarchy, and create distance to school and distance to work sub-criteria for the location part of the hierarchy.

Step 5 — Assign Weights to the Criteria

Remember that, in Tetra GDM, you must be the Model Owner in order to perform this step.

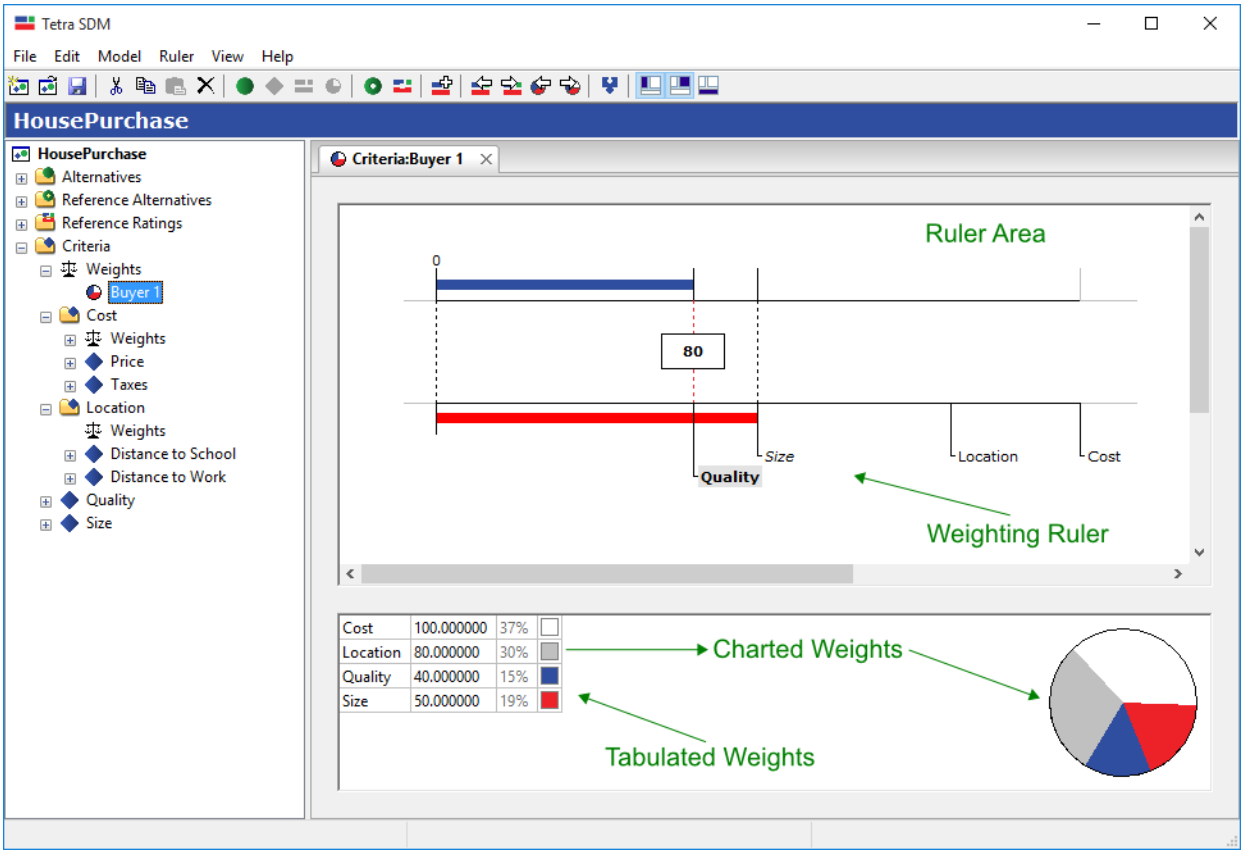
Defining the weights establishes the relative importance of the various criteria involved in making the decision. Weights are assigned using the same hierarchy as the criteria tree.

Tetra actions to create a set of weights:



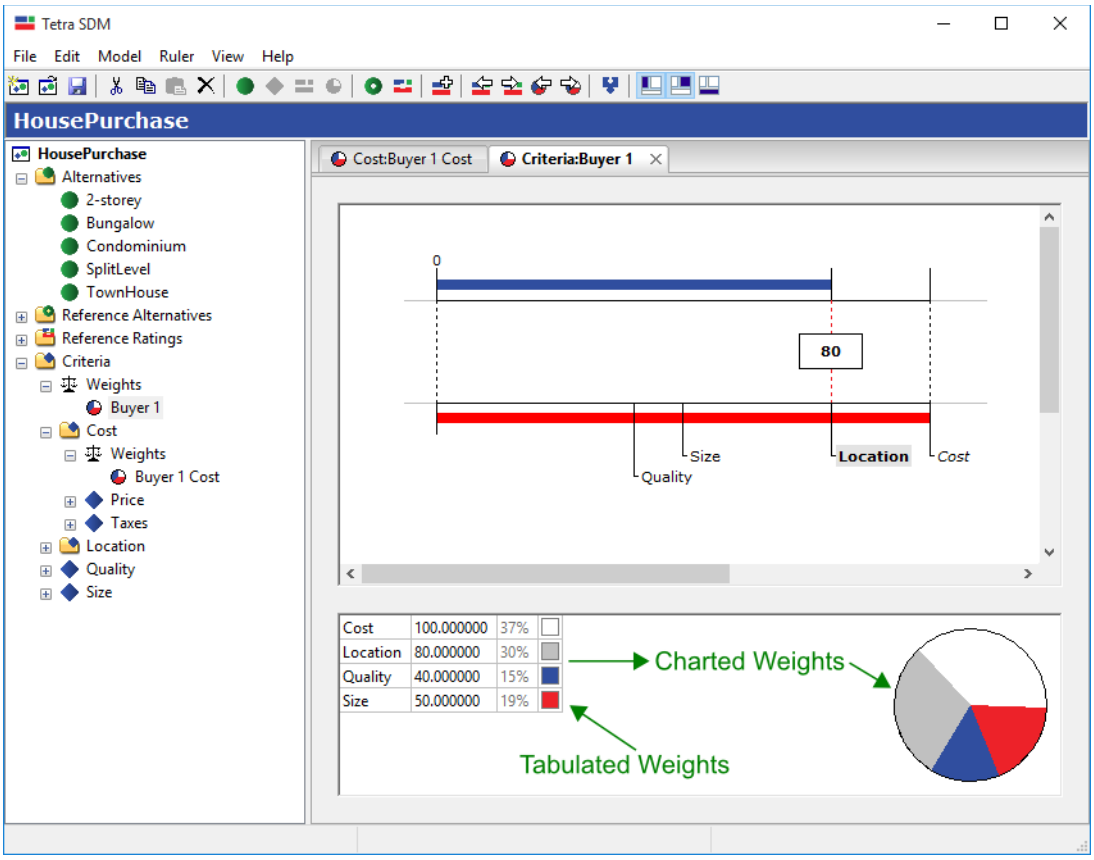
- Right click on the word Weights in the model tree, immediately below the top-level criteria folder and Select New Criteria Weighting, or select the word Weights under the top-level criteria folder and click on the New Criteria Weighting icon ◔ in the toolbar. You may give the set of weights a name if you like.
- Double-click on the label for the current set of weights in the criteria tree ("Buyer 1" in this case). A blank weighting ruler will appear in the ruler area.
- Right click anywhere in the ruler area, select Add Criterion, then Add All. The resulting figure is shown below.
- The weights are relative, so the method works by setting one criterion as a "standard" against which the importance of another one is specified. Tetra initially sets one arbitrary criterion as the reference weight (Size in the figure), with a magnitude indicated by the red bar. The blue bar is associated with one other criterion weight (Quality in the figure). The length of the blue bar relative to the red bar, quantified by the boxed

percentage between the rulers in the figure, corresponds to the relative importance of these two criteria (i.e. Quality is 80% as important as Size in the default set-up shown below).



Tetra actions to assign the weights for the top-level criteria:

- Right click the criterion label on the weighting ruler that you want to use as the standard (say Cost), and select Set Right. The red bar is now associated with the Cost criterion.
- Click on the Cost criterion on the ruler, and drag it somewhere to the right of all the other criteria. Then right click in a blank area of the ruler window, and select Expand. This changes the view of the ruler for easier visualization – it does not alter the values of any of the weights.
- Drag the label for one criterion at a time in the figure, until its weight (or relative importance) relative to Cost is where you want it. For example, suppose that you consider the Location of the house to be 80% as important in your decision-making as the Cost factor; then drag the Location label until the proportion of the blue bar to the red bar is 80%, as shown in the figure below.

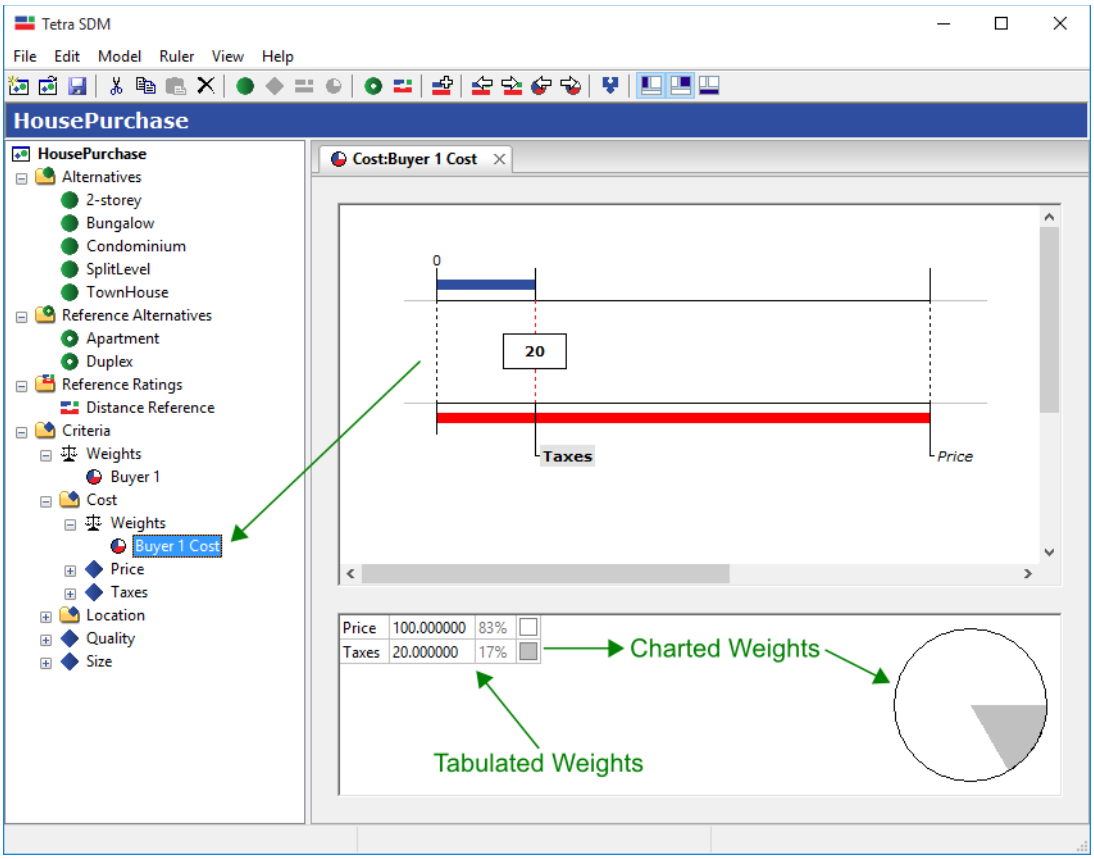


- Repeat this procedure for the remaining two criteria, assuming for this exercise that house Size is 50% as important as the Cost, and that the Quality criterion is assigned a 40% weight relative to Cost.
- (Optional) You may enter more precise values directly into the Tabulated Weights cells in the lower pane. These proportions are reflected in the Ruler Window.
- Note that it is only the relative values of weights that are significant. For example, the same result would be obtained if two criteria, Size and Cost were given weights of 1 for Size and 2 for Cost or 50 for Size and 100 for Cost.

Tetra actions to assign the weights for the sub-criteria:

This procedure is essentially the same as the preceding step, except for two variations:

- Start by clicking on the Weight label in the criteria tree that is associated with the sub-criteria for which you want to assign weights. As shown in the figure, to assign weights to the two sub-criteria associated with Cost, right click on the word Weight under the Cost branch, select New Criteria Weighting, and then continue as above.
- When right clicking on the weighting ruler to add criteria, only the set of corresponding sub-criteria will be available (Price and Taxes in this case).
- To complete the weighting of sub-criteria, set the sub-criterion Taxes to be 20% of the weight of Price, and the sub-criterion Distance To Work to have an importance weight of 40% relative to Distance To School.



A different perspective to entering weights is to think in terms of ratios. For example, if you consider Price to be 5 times as important as Taxes for making your decision, you could enter a value of 1.0 in the Taxes cell in the tabulated weights, and a value of 5.0 in the Price cell. The length of the red and blue bars in the weighting ruler will adjust accordingly. (You can then expand the ruler to give the figure above).

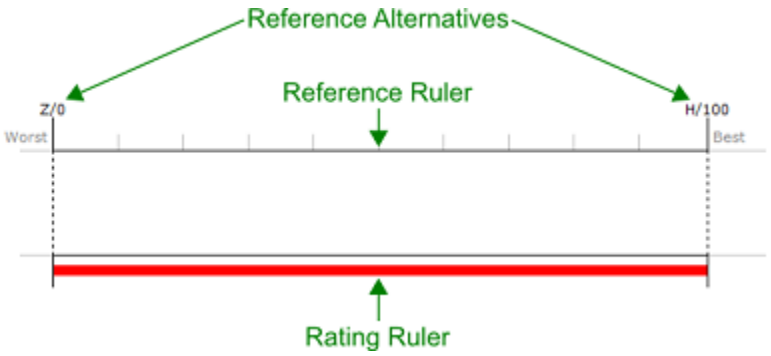
As you work on weighting (and, later, on ratings), remember that the changes you make to rulers are not automatically saved as you go along. You must save the model in SDM to preserve changes. In GDM you may: i) close the ruler (the X in the ruler tab), or ii) save the changes via the Save Ruler / Save All Rulers commands in the toolbar or Ruler menu.

Step 6 — Establish reference alternatives for each criterion.

At least two reference alternatives must be defined for each criterion on which the alternatives (the five houses) are rated, in order to establish a scale. This can be done by selecting a reference rating ruler or by associating actual or hypothetical objects with the default reference objects 'Z' and 'H' where 'Z' is an alternative or object that scores zero for that criterion and 'H' is an object that scores 100 for that criterion. Note that the reference alternatives are objects, i.e. their definition requires nouns rather than adjectives.

- Using hypothetical alternatives: For example, a hypothetical ‘Z’-object for the Quality criterion could be a squalid bachelor apartment and a hypothetical ‘H’-object for the Quality criterion could be a mansion.
- Using actual alternatives: Another way to establish ‘Z’ and ‘H’ reference objects is to use two of the current alternatives. In our example, the ‘Z’-object for the Quality criterion could be the townhouse, and the 2-storey house may serve as ‘H’-object.

There are no Tetra actions required for this step - all that is needed is a clear definition of the reference alternatives for each of the six end-criteria, so that when ratings are made in the next step, they are done relative to these reference objects. The figure below shows how these concepts relate to the rating tools which will be invoked in the next section.



Suppose that these are the extreme alternatives associated with each of the six criteria:

		Bottom	Top
Criteria	Price	2-storey	townhouse
	Taxes	2-storey	condominium
	Distance to School	bungalow	split-level
	Distance to Work	2-storey	condominium
	Quality	townhouse	2-storey
	Size	condominium	2-storey

Note that for Price, the ‘H’-object is the cheapest alternative and the ‘Z’-object is the most expensive. For Distance to School, the ‘H’-object was chosen as the closest alternative and the ‘Z’-object is the farthest away.

In some decision-making situations, an Evaluation Plan is set up for the purpose of assessing future alternatives. In this case, the criteria are defined, weights selected, and reference alternatives are established in advance. Since the actual alternatives are not known when the

Evaluation Plan is set up, hypothetical alternatives must be used to define the reference objects in the Evaluation Plan for each criterion.

Step 7 — Rating the alternatives against each criterion

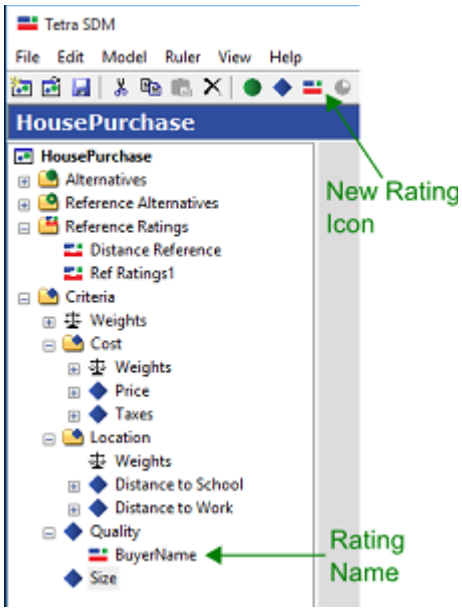
All of the alternatives (the five houses) must be rated according to each of the 6 end-criteria.

If you are using Tetra GDM, this step is carried out by each of the Decision Makers involved. After you finish working through this guide as the Model Owner, create another Decision Maker, close the model and reopen it as this Decision Maker. Enter ratings for that Decision Maker using the same process described here, then close and open the model as the Model Owner again, so you can solve the model again to see the changes in the combined ratings.

When you open the model in Tetra GDM the model owner may view (but not modify) the ratings of other Decision Makers. This is particularly useful when reviewing ratings as a group, as it makes it easy to move between and compare the ratings of all the Decision Makers involved in the process.

Tetra actions to rate alternatives against criteria:

- Right click on any criterion in the criteria tree (such as Quality) and select New Rating (or click on the new rating ruler icon in the menu bar) to create a new rating ruler. You may enter a name for this set of ratings if you choose (such as BuyerName).
- Double click the label for the current set of ratings ("BuyerName" in this case) in the criteria tree and a blank rating ruler will appear in the ruler area.
- Right click anywhere in the ruler area, select Add Alternative, then Add All.
- Using values from the table below, enter the ratings of the alternatives for each of the end-criteria. Note that for some criteria, such as Price, a higher value is worse; so in this example the more expensive 2-storey house is rated the lowest on the Price criterion.



		House (alternatives)				
		2-storey	bungalow	condominium	split-level	townhouse
Criteria	Price	0	30	60	25	100
	Taxes	0	35	100	50	60
	Distance to School	65	0	45	100	25
	Distance to Work	0	10	100	85	25
	Quality	100	75	40	50	0
	Size	100	60	0	60	35

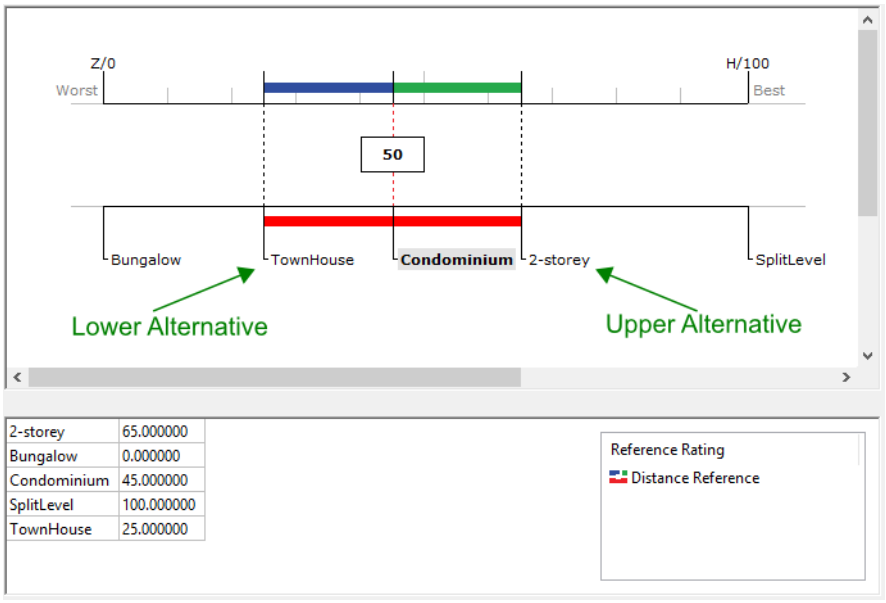
Once you have the alternatives on the rating ruler, you can specify values for the ratings of each alternative in two ways:

- You can enter numerical values into the value entry table below the ruler.
- You can drag the alternatives along the ruler to specify the ratings.

In addition to specifying ratings for alternatives, Tetra also lets you specify relative ratings between alternatives. To do this, lower and upper alternatives are used. By default, the value 0 (reference alternative Z/0) is used for the lower reference alternative, and the value 100 (reference alternative H/100) is used for the upper reference alternative. To choose a different lower or upper reference alternative, right click on the alternative or reference alternative you wish to use and choose Set Left or Set Right, respectively. In the figure, the Townhouse has been set to be the lower alternative and the 2-storey has been set to be the upper alternative.

In the rating ruler, the red bar indicates the difference between the upper and lower alternatives. When an alternative is selected, the blue bar indicates the difference between this alternative and the lower alternative and the green bar indicates the difference to the upper one. Furthermore, the value in the box on the line above the selected alternative shows the relative rating of the selected alternative as compared to the lower and upper alternatives (the ratio of the blue bar to the red one). In the figure we see that the Condominium is rated as being half-way between the Townhouse and the 2-storey with respect to this criterion. You can set the lower and upper alternatives back to the value 0 or the value 100 by right clicking anywhere in the rating ruler and choosing Clear Left or Clear Right, respectively.

Here is what the rating ruler for one of the criteria, Distance to School, might look like.



Step 8 — Solve the Model to Determine the Preferred Alternative

Remember that, in Tetra GDM, you must be the Model Owner in order to perform this step.

The preference function modelling methodology can now be applied to rank the five alternatives (the houses) according to their rating on each of the six criteria, and the relative importance of the criteria.

Tetra actions to run the solver:

- Click on the Solve icon in the menu bar.
- The results of the numerical ranking, the Overall Preference Scale, are shown in the solution output dialog.
- Using ratings and weightings similar to those presented in this example yields an overall preference scale such as the one in the screen capture. According to this result, the best decision is to buy the Split-Level house.