

Evaluation and Decision-making

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...the universities. The inertia of the human mind and its resistance to innovation are most clearly demonstrated not, as one might expect, by the ignorant mass but by professionals with a vested interest in tradition and in the monopoly of learning. Innovation is a twofold threat to academic mediocrity: it endangers their oracular authority, and it evokes the deeper fear that their whole, laboriously constructed intellectual edifice might collapse.

Howard's "Religious Spectrum of Decision Analysis"

- Howard: "In Praise of the Old Time Religion"
- To Howard's "Heathens, Heretics, and Cults" add Utility Fanatics.
- Science is not a religion.

Von Neumann and Morgenstern's Utility Theory

- The right proof of the wrong claim. The operations of addition and multiplication are not applicable and there are other major problems.
- Inadequate mathematical basis to utility theory, the theory of games, economics, decision theory, mathematical psychology and other fields.

Does It Matter?

- You don't need to study thermodynamics to drive a car.
- Provided someone else did.
- Practitioners assume that a sound theory underpins decision analysis, but this is not the case.

Serious Practical Implications

- Public procurement in Canada is a \$14B p.a. business.
- You lost the bid with a score of 69. 654321...
- But the error was 10% and the numbers were meaningless; “on a scale of 1-10”
- The AHP, weights, ratios, units (Roberts), hierarchies, “multiplicative length,” +++

It Can Be Done - Easily

- Only two operations (repeated). Intuitive and simple.
- Time ratios are undefined.
- Ratios of differences – follows.

“It Takes Half an Hour...”

$$(t_a - t_d) = \frac{1}{2}(t_1 - t_0)$$

$$\frac{(t_a - t_d)}{(t_1 - t_0)} = \frac{1}{2}$$

Group Decision Making

- “Arrow’s Impossibility Theorem” – another case of mis-interpretation.
- The ordinal case is irrelevant.
- A constructive theory cannot be based on a negative result.
- Group Decision Making can be done – theory and practice – easily.

Keeping the Math Under the Hood

- Tetra is a software package for measurement of preference. It is based on Preference Function Modeling (PFM).
- There are only two operations which are repeated: weighting the criteria and rating the alternatives.
- It is intuitive and easy to learn and use.

Group Decision Making

- Tetra is also a powerful tool for group decision making.
- It is flexible and can be tailored to specific applications.
- Artificially forced consensus is not imposed on Decision Makers. Tetra supports non-collaborative as well as collaborative decision making.

Local or Remote

- Tetra has full database and communications capabilities.
- Decision making may be interactive or not.
- Inputs may be provided through local or remote networking.

A Multi-Use Tool

- Procurement Evaluation;
- Budget Allocation, Project Priorities;
- Strategic Planning, Performance Measurement;
- Engineering Design, Urban Planning;
- Personnel Merit Boards ,Marketing, Hiring.

What is PFM?

- Preference Function Modelling (PFM) is a methodology for decision making, evaluation, and measurement of preference.
- PFM is the result of research since the 1980's into Decision Theory and the Theory of Measurement.

Why PFM?

- The mathematics of evaluation is difficult.
- PFM is based on sound mathematical foundations. It avoids the pitfalls common to classical evaluation methodologies.

A “Weighted-Sum” Example

- A Decision Maker is evaluating two job offers.
- The criteria are professional interest and salary.

	Professional Interest (.6)	Salary (.4) (\$K/Yr)	Weighted Sum
Position 1	15	50	$=.6*15+.4*50=9+20=29$
Position 2	20	45	$=12+18=30$

Prefer #2



	Professional Interest (.6)	Salary (.4) (\$/Yr)	Weighted Sum
Position 1	15	\$50,000	$= .6 * 15 + .4 * 50000$ $= 9 + 20000$ $= 20029$
Position 2	20	\$45,000	$= 12 + 18000 = 18012$

Prefer #1

Advantages of Tetra

- The math is “under the hood,” common pitfalls are avoided and bias is minimized.
- The difficulties include issues of “verbal scales,” measurement units, interpretation of “relative importance” vs. weighted sums, group decision making, etc., etc.

Tetra Screen Shots

Tetra SDM

File Edit Model Ruler View Help

House Purchase

Criteria: Buyer Price: Buyer Quality: Buyer Distance to School: Buyer

House Purchase

- Alternatives
 - 2-storey
 - Bungalow
 - Condominium
 - Split-level
 - TownHouse
- Criteria
 - Weights
 - Buyer
 - Size
 - Buyer
 - Cost
 - Weights
 - Buyer
 - Price
 - Buyer
 - Taxes
 - Buyer
 - Quality
 - Buyer
 - Location
 - Weights
 - Buyer
 - Distance to School
 - Buyer
 - Distance to Work
 - Buyer

Navigation Pane

Content Pane

Ruler

0 100

Bottom Top

60

2-storey Bungalow Split-level Condominium TownHouse

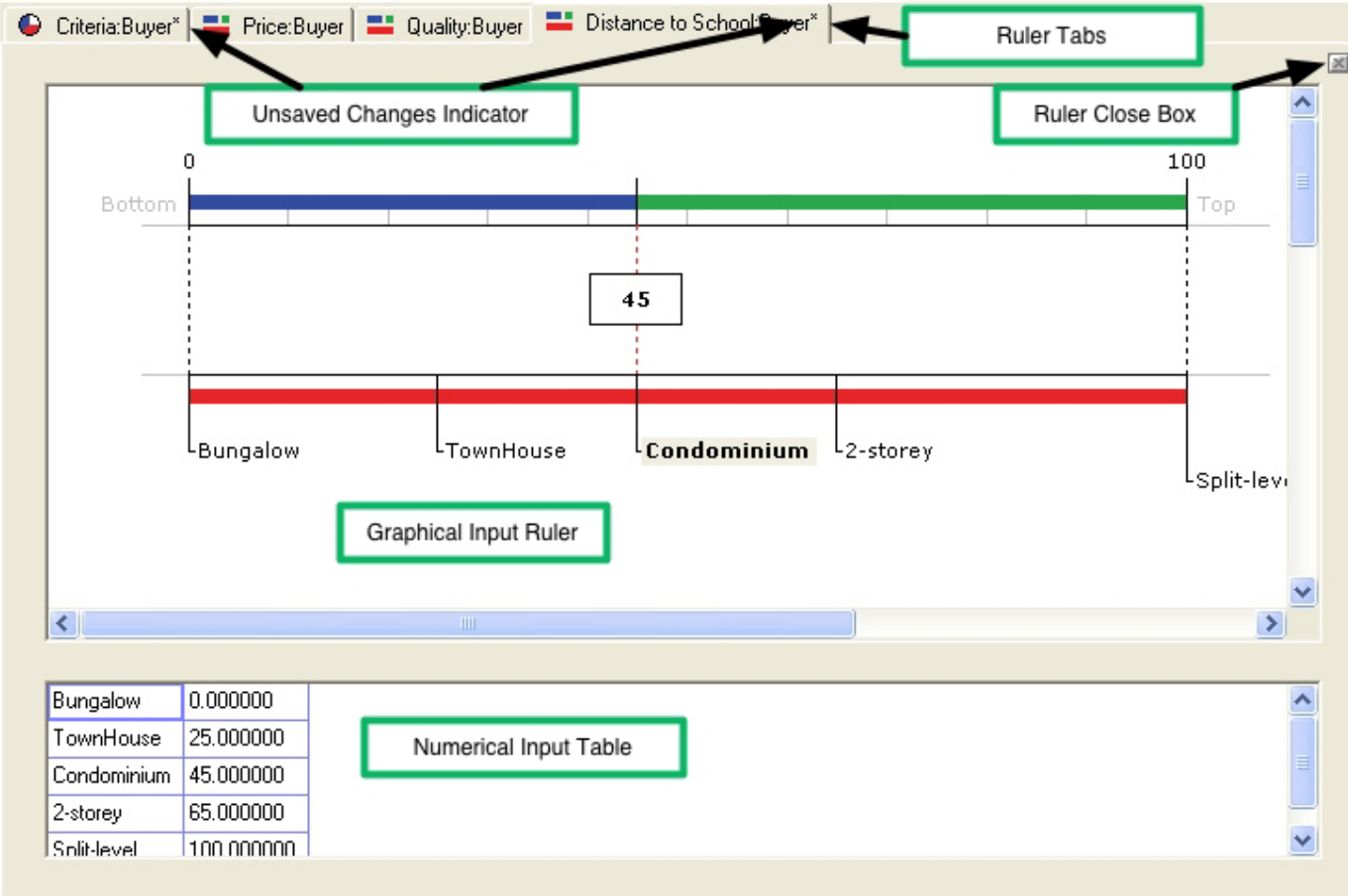
2-storey	0.000000
Split-level	25.000000
Bungalow	30.000000
Condominium	60.000000
TownHouse	100.000000

Weighting Ruler

Output Pane

2-storey	47.962
Bungalow	25.625
Split-level	68.743
Condominium	47.558
TownHouse	54.770

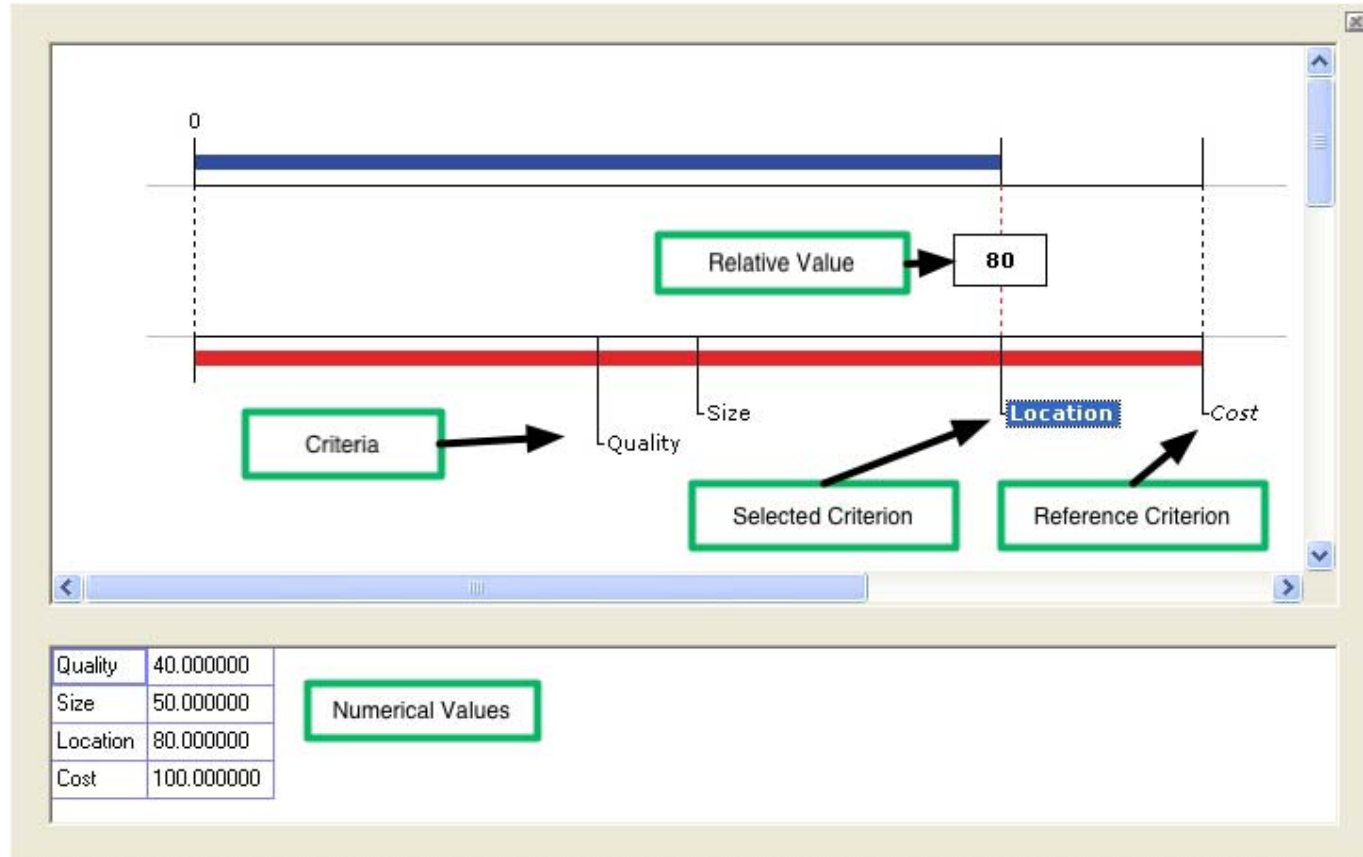
Tetra Interface



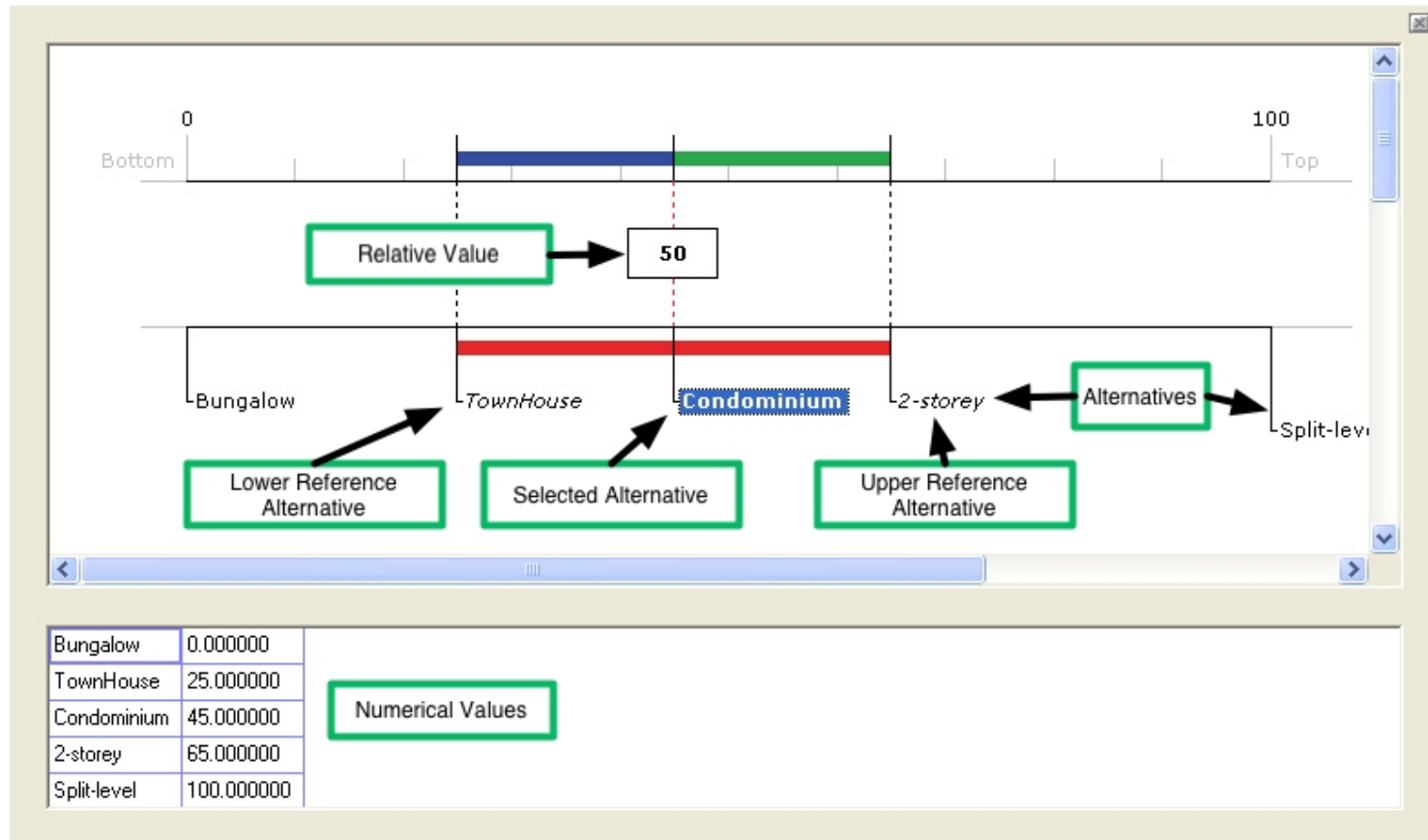
The screenshot displays a software interface for a graphical ruler. At the top, there are tabs for 'Criteria:Buyer*', 'Price:Buyer', 'Quality:Buyer', and 'Distance to School:Buyer*'. A 'Ruler Tabs' label points to these tabs. Below the tabs is a horizontal ruler with a scale from 0 to 100. The ruler is divided into segments: 'Bungalow' (0-25), 'TownHouse' (25-45), 'Condominium' (45-65), '2-storey' (65-85), and 'Split-level' (85-100). A vertical dashed line is positioned at the 45 mark, with a box containing the number '45' next to it. An 'Unsaved Changes Indicator' is located at the top left of the ruler area, and a 'Ruler Close Box' is at the top right. Below the ruler is a 'Graphical Input Ruler' label. At the bottom, there is a 'Numerical Input Table' containing the following data:

Bungalow	0.000000
TownHouse	25.000000
Condominium	45.000000
2-storey	65.000000
Split-level	100.000000

Ruler With Tabs



Weighting Ruler



Rating Ruler