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# 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.

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# 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.

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# "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.

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# 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.

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# Tetra Screen Shots

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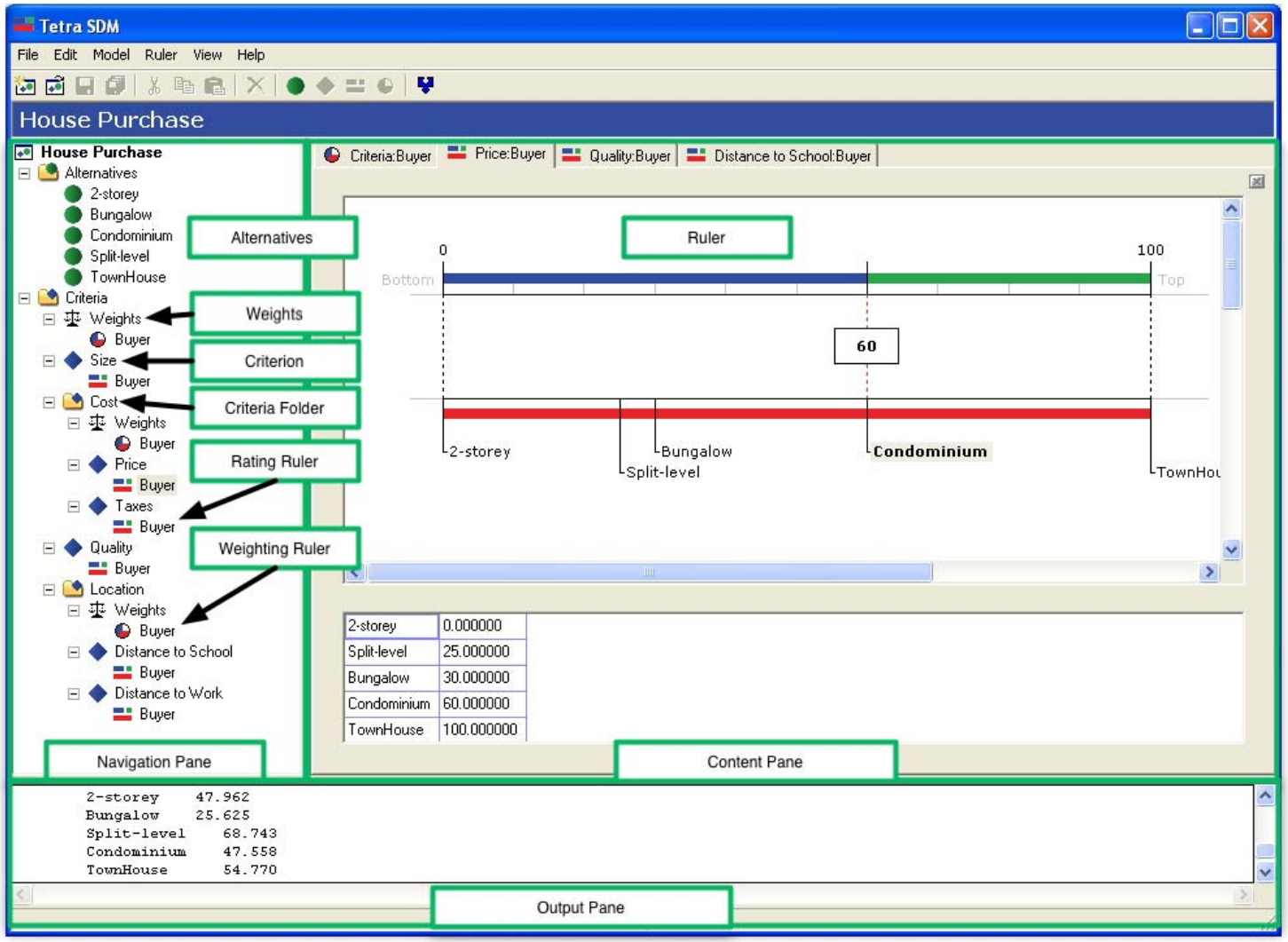
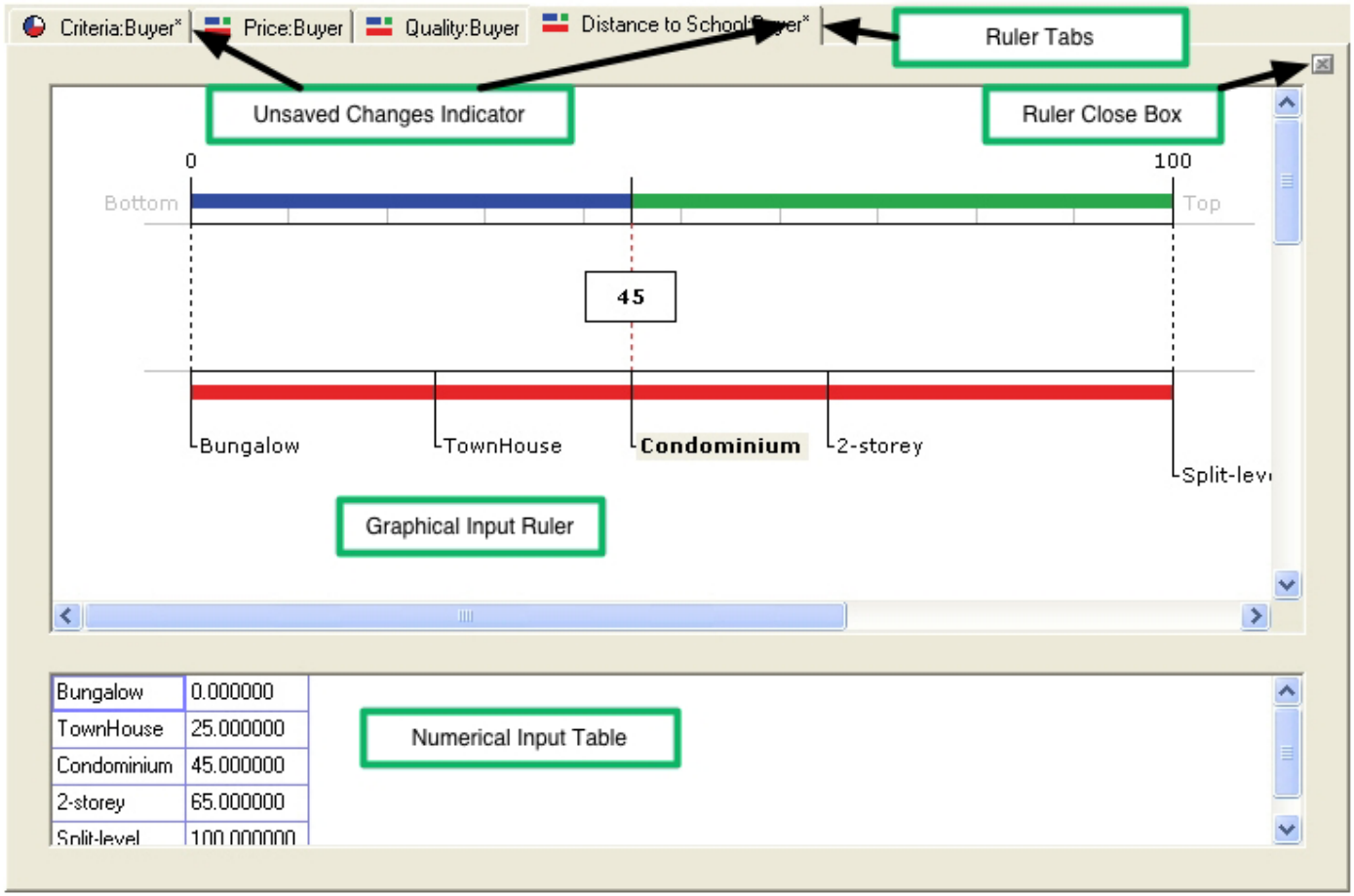
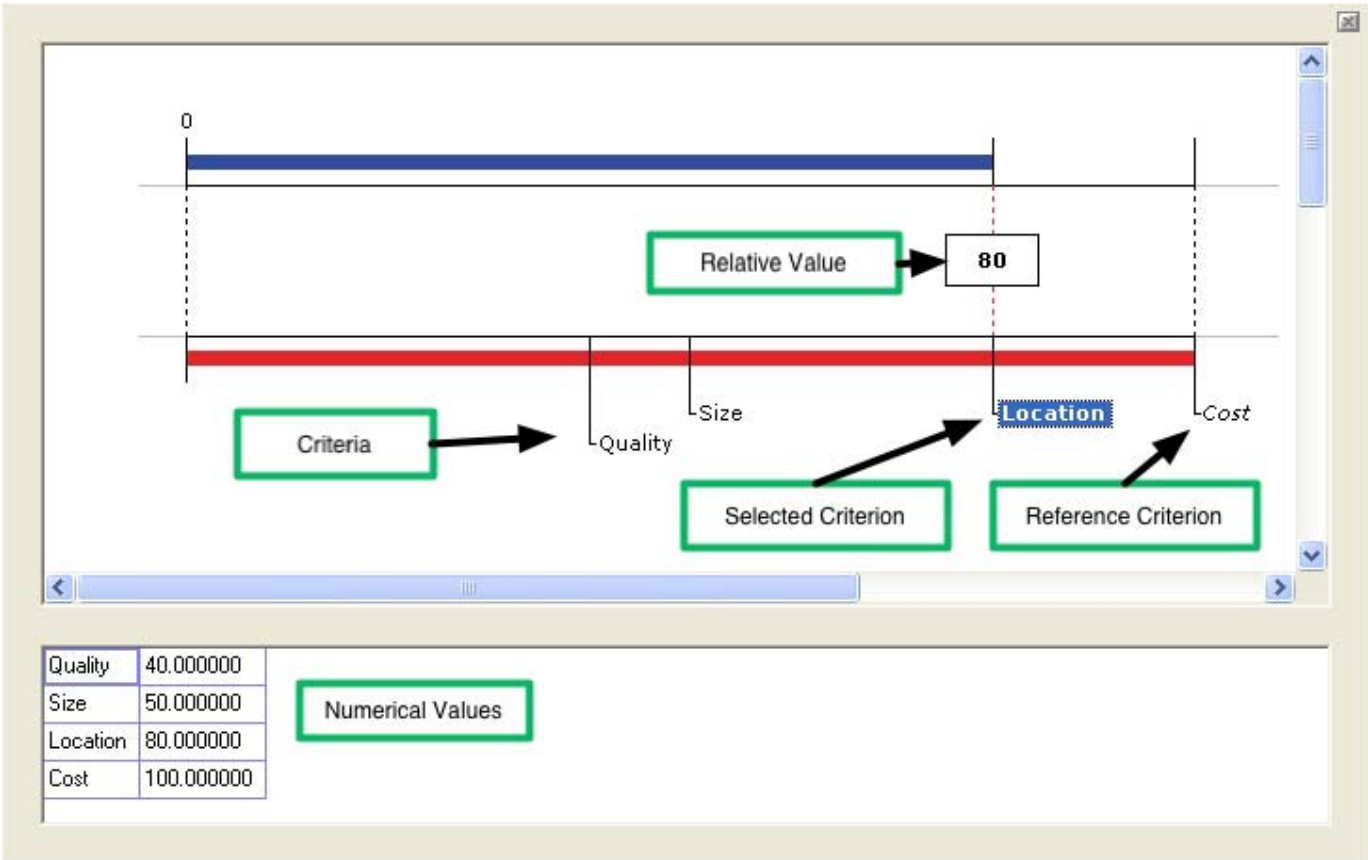


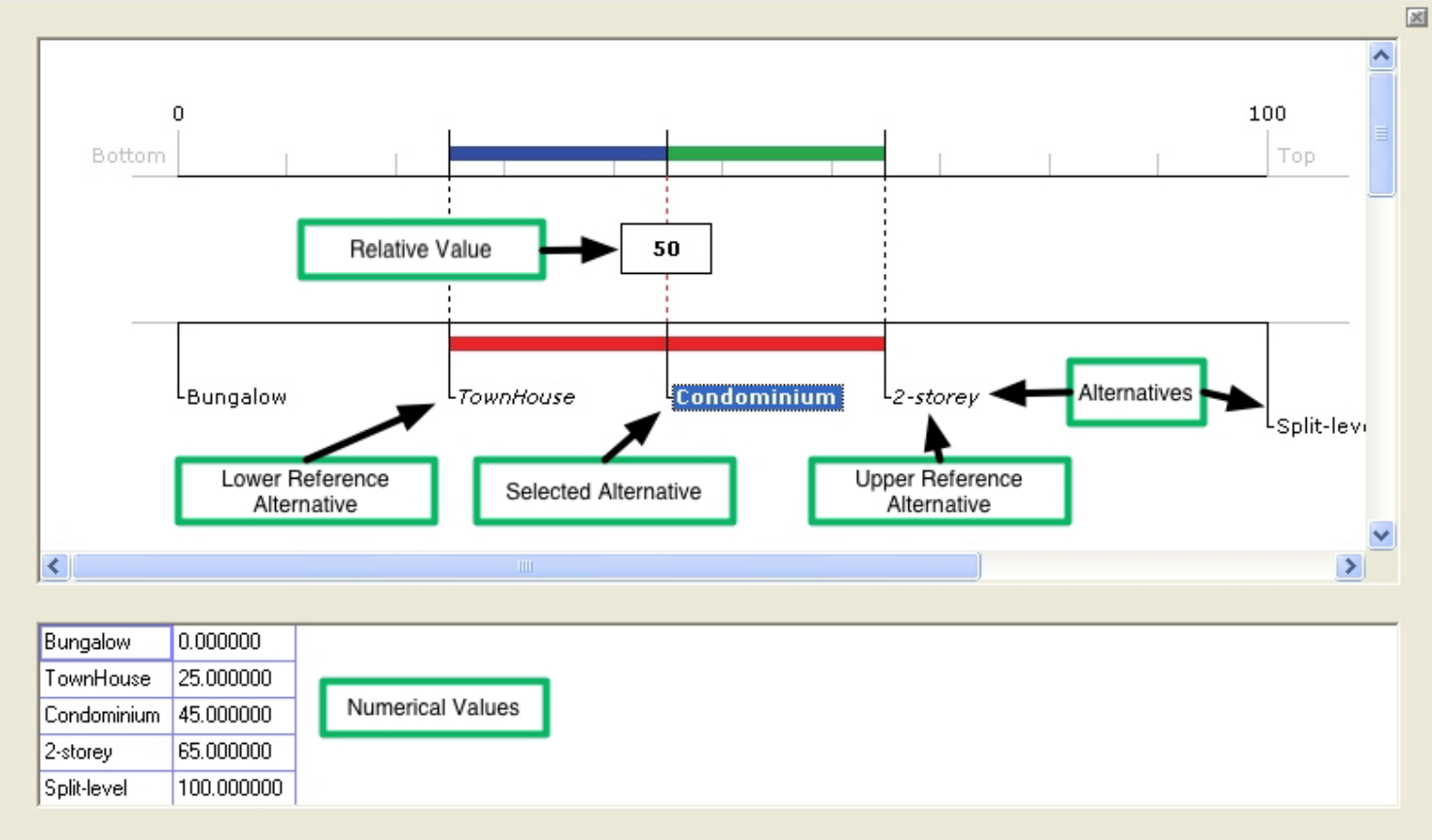

**Tetra Interface**




**Ruler With Tabs**




**Weighting Ruler**




**Rating Ruler**