INTRODUCTION TO MULTICRITERIA DECISION ANALYSIS (MCDA)

03 – Analytical Hierarchical Process (AHP)

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SNEAK PEEK

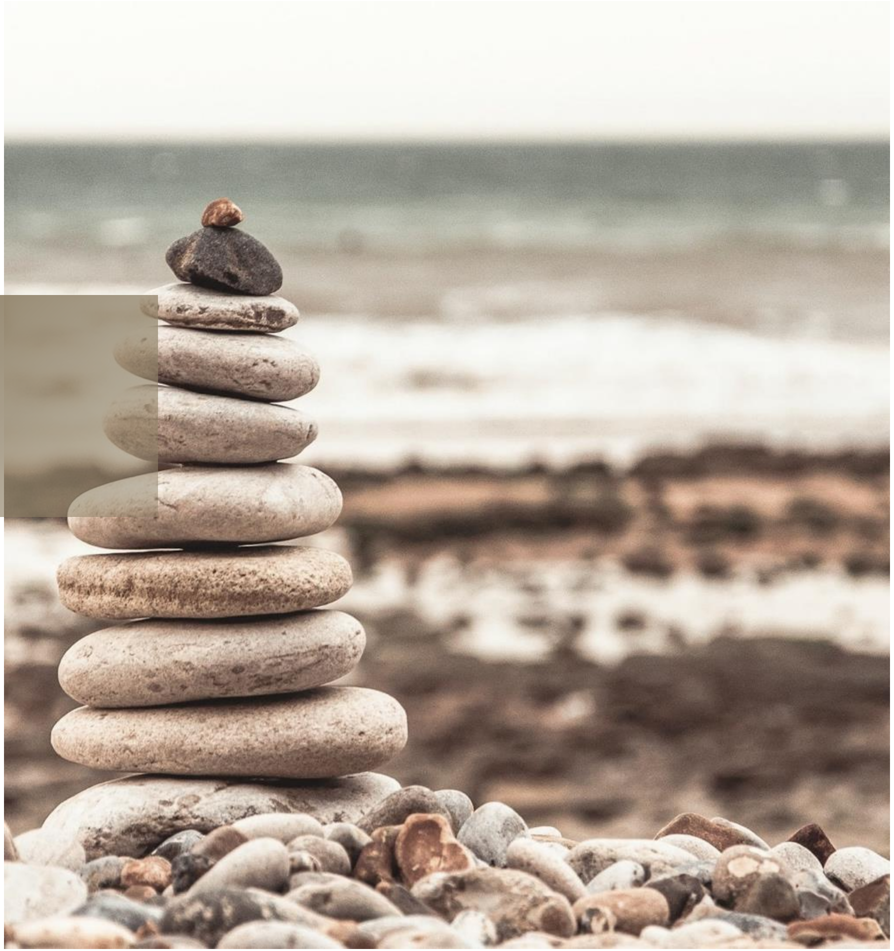
Today we are going to explore the most famous method in MCDA (probably) – the Analytical Hierarchical Process (AHP).

I hope you had time to read the corresponding materials, and let’s dive in!

TABLE OF CONTENTS

Recap

- As is the set of alternatives ($A = \{a_1, a_2, \dots, a_m\}$).
- These alternatives can be analyzed through a set of orderable criteria X_g: $(<_g, X_g)$.
- Each criterion $g(a)$ may be used in a quantitative way to inform us about its importance
- Criteria can thus be compared - $g(a) > g(b)$.
- Comparisons can take many forms, according to each method (dominance): preference (strict or pure versus weak), indifference, or incomparability.
- In most methods, we can also gauge the intensity or degree of preference.
- Given that $g_1(a), \dots, g_n(a)$ and $g_1(b), \dots, g_n(b)$, a logic of aggregation will somehow compare both alternatives
- Other inter-criterion and technical parameters (weights, scales, constraints, etc.) can also be parts of the method.



ANALYTICAL HIERARCHICAL PROCESS (AHP)

the most popular guy in school

What does AHP stand for?

AHP stands for **Analytic Hierarchy Process**.

AHP is a structured decision-making method that helps compare multiple criteria and find the best option when there are conflicting factors.

As part of the Multi-Attribute family of MCDA methods, its goal is finding the best alternative within a set of alternatives, but not through optimal solutions based on mathematical constraints.

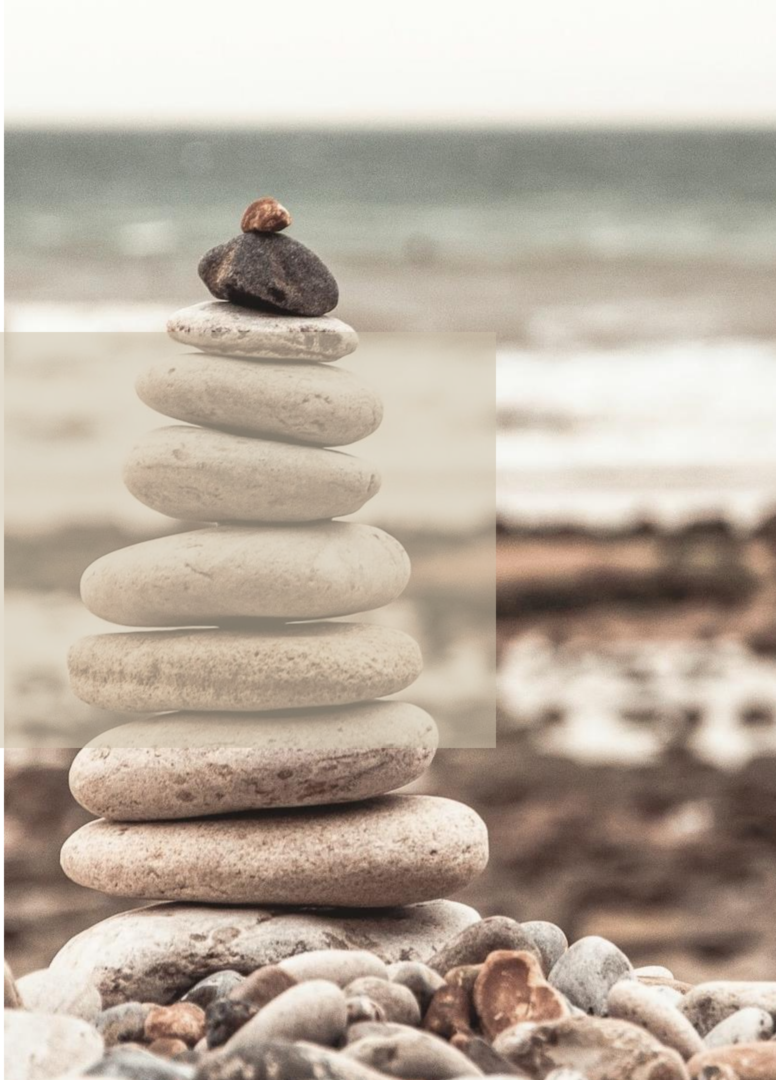
Is AHP a method?

- Yes, but also no.

- AHP in its pure, classic form is a method, but even the "original" AHP has two flavors (which we will explore in a bit).
- In addition, there is a lot of development and many, many alterations in the method.

- Think of it as a new boss who thinks she can better organize the company, until the next boss that introduces new changes, and so on.

- We are going to focus today on the classical forms of AHP.

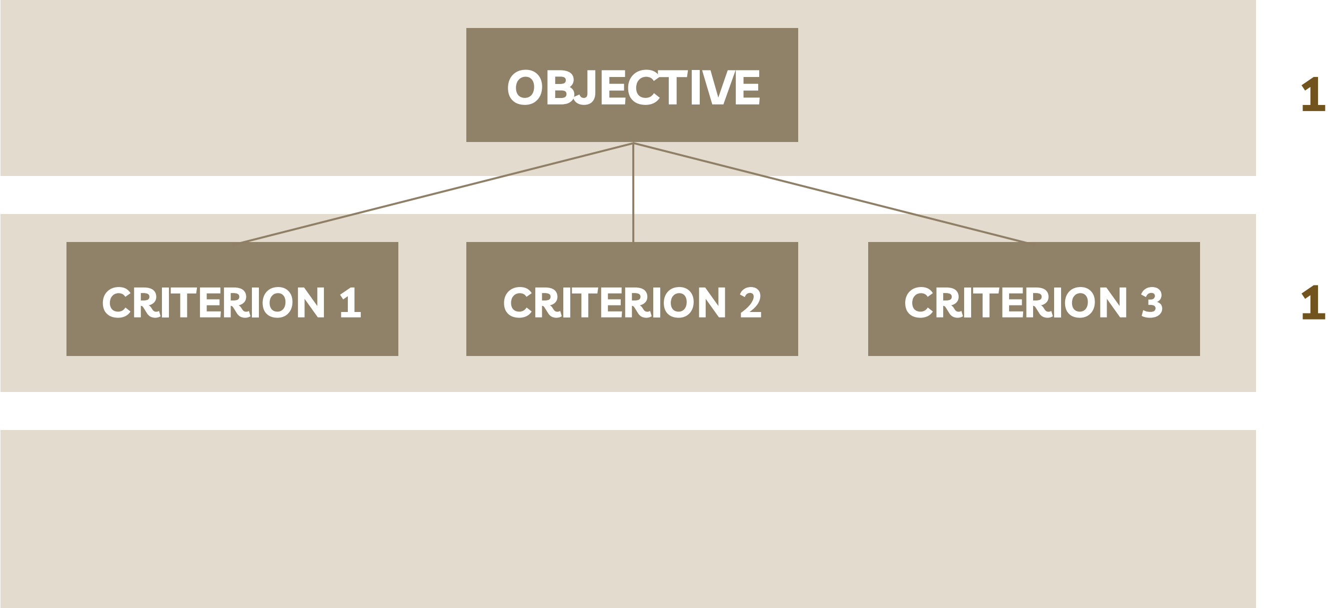


AHP – STEP BY STEP

- Since AHP stands for Analytic Hierarchy Process, we need to imagine our problematic, set of criteria and set of alternatives in a hierarchical way.
- Our first goal is to think about an objective
- Let's give this a total weight of 1 – and therefore we will operate in smaller numbers (eg.: 0.34)

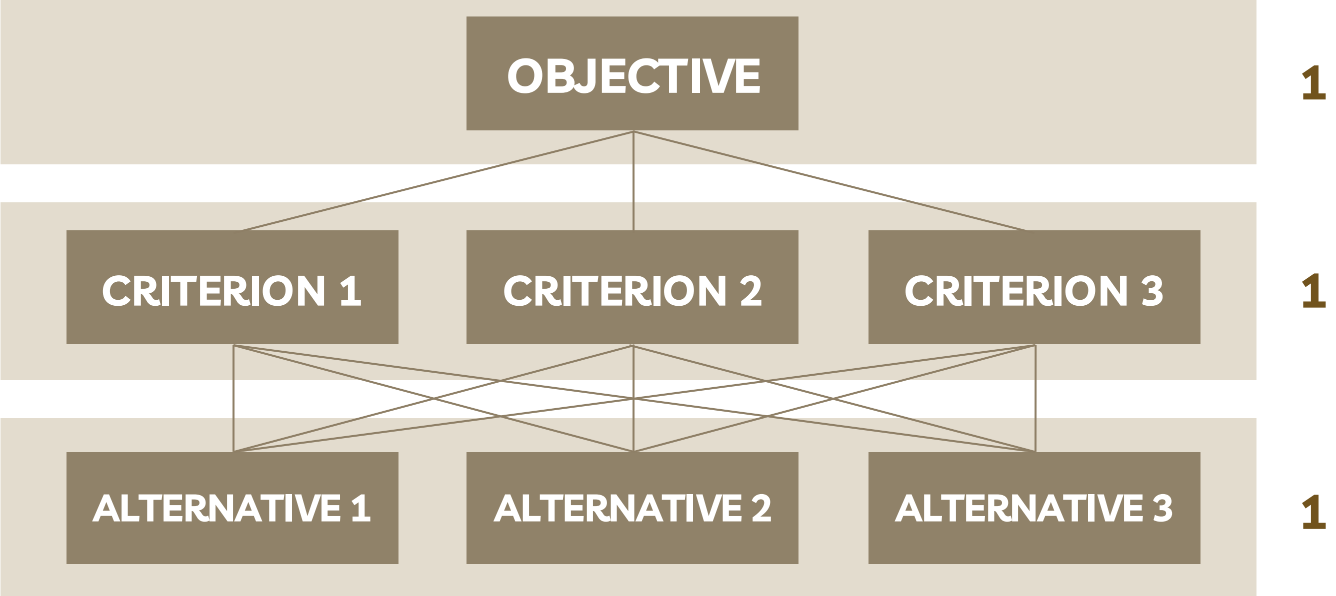
AHP – STEP BY STEP

- We can now “break it down” into components (criteria, attributes, etc.)
- We could break criteria into sub-criteria but for now let’s focus on the core aspects of the method.
- Do you still remember the basic tenets we need to consider when choosing criteria?
- We will also give the second level a total of 1 point.



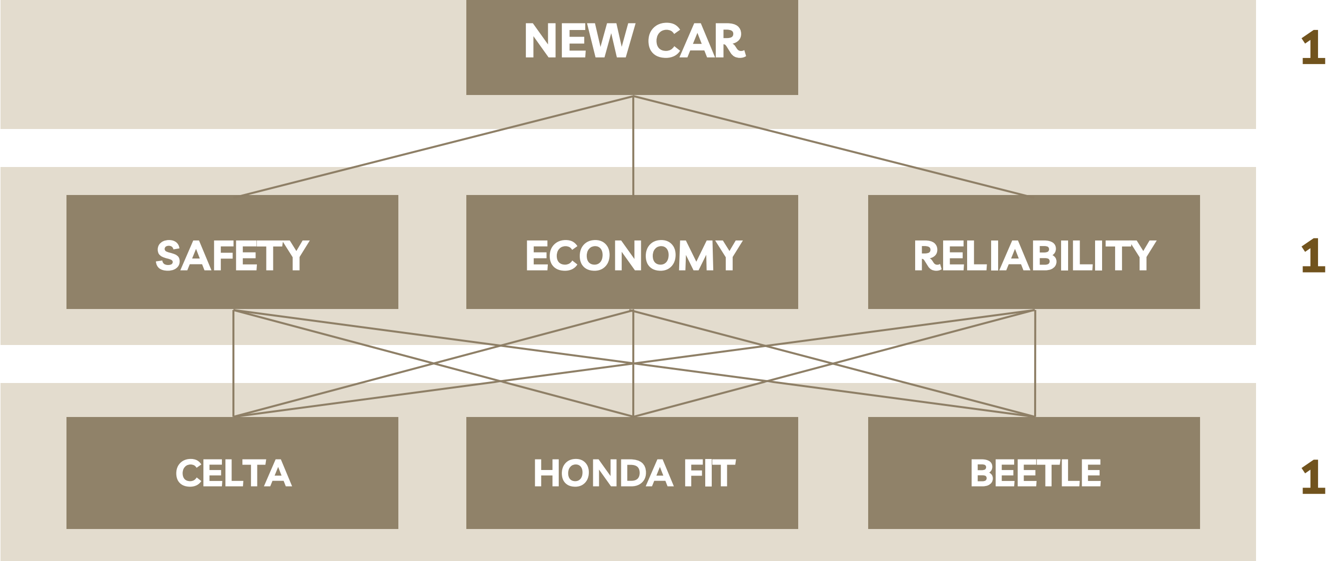
AHP – STEP BY STEP

- In AHP alternatives are optional – i.e., since the model is hierarchical, we could stop at the second level.
- As you probably figured it out, the alternatives also receive a total of 1.
- If you counted the number of lines between level 2 and 3, you now understand why we need parsimony.



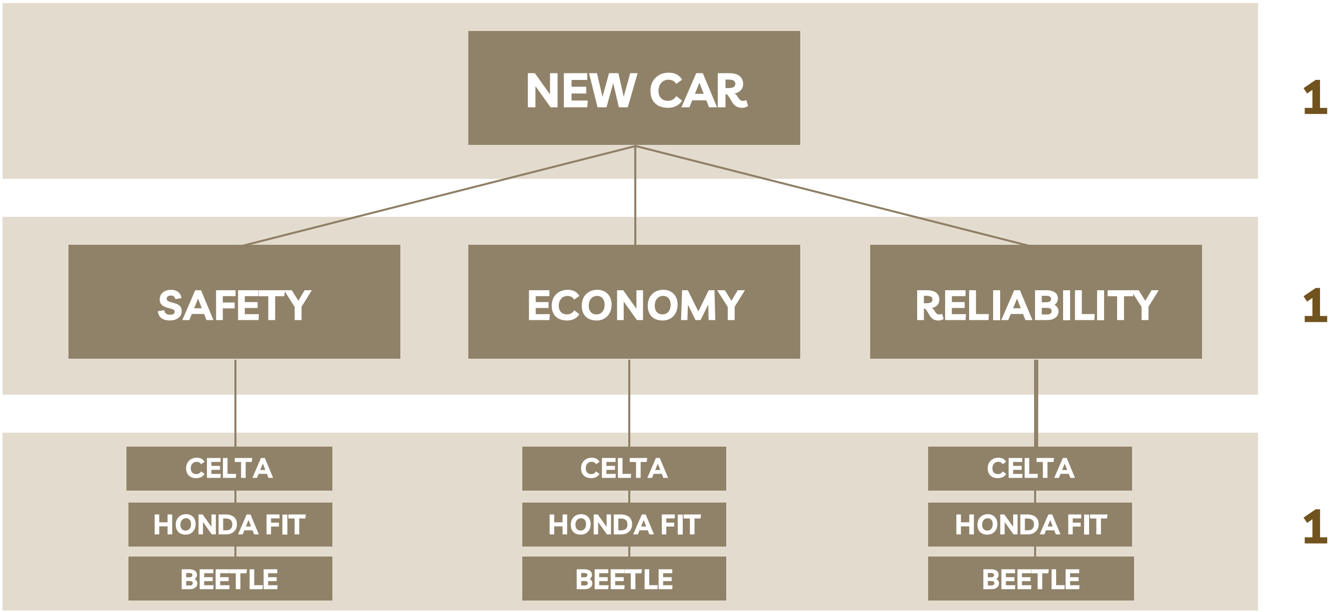
AHP – STEP BY STEP

- In AHP alternatives are optional – i.e., since the model is hierarchical, we could stop at the second level.
- Also, in AHP there is no numerical difference between a criterion and an alternative.
- As you probably figured it out, the alternatives also receive a total of 1.
- If you counted the number of lines between level 2 and 3, you now understand why we need parsimony.



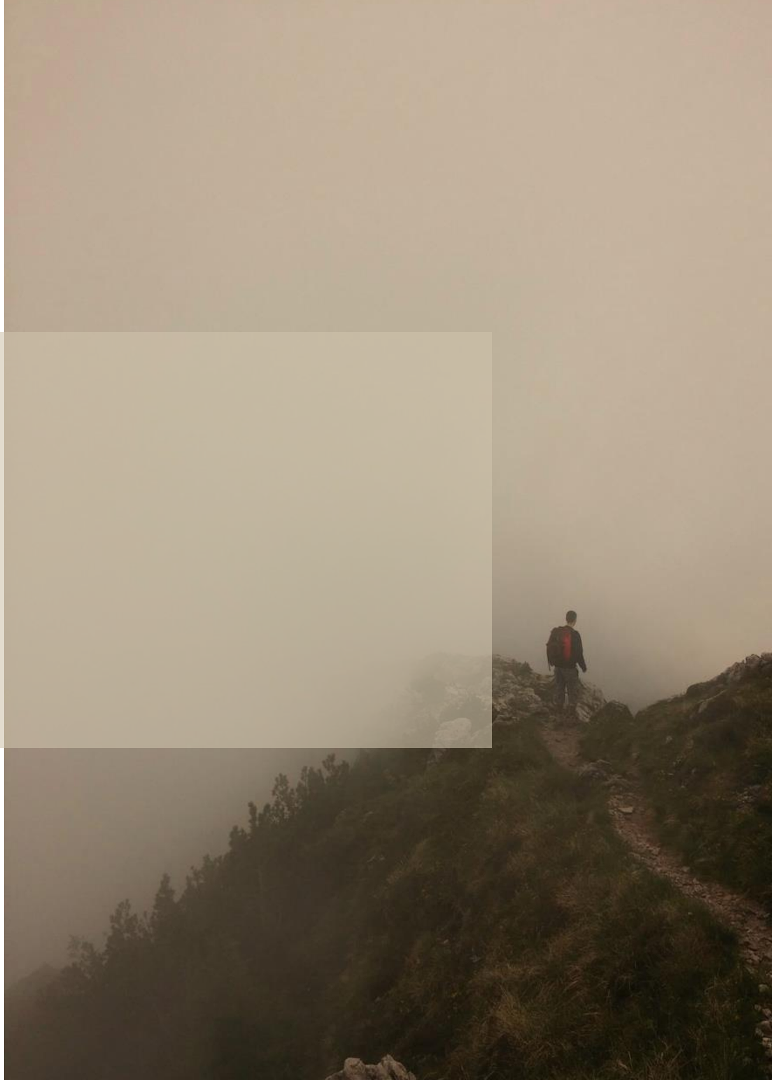
AHP – STEP BY STEP

- You could also think about this in a different visualization:
- You will judge every alternative against every criterion and then aggregate this into one objective.



TWO WAYS

- AHP can be used with “**qualitative**” and “**quantitative**” data
- By “qualitative” data we mean using **verbal descriptors** – but these are transformed underneath to numerical scales
- By “quantitative” data we mean **real positive numbers** (discrete or continuous, normalized)
- In the end, we end up with a “scale” of numbers



SCALE ("QUALITATIVE")

- In AHP, we need to **compare two alternatives by breaking them down to criteria**.
- The comparison is not done by alternatives (as in the outranking methods), but rather indirectly by **pre-ordering the importance or weight of each criterion**.
- To do so, we **compare criteria in a pairwise procedure** (one against the other, hence the parsimony in the model).
- Let's assume we have a set of alternatives $A = \{a, b\}$.
- Let's imagine a monocriterion decision based on $g(x)$.
- Since $g(x)$ is inherently a quantitative relationship, we need to transition from "perception" or "judgement" to this numerical ratio.
- Saaty (the author of AHP) developed a "scale" that can be used to do this:

Intensity of importance	Definition
1	Equal importance
3	Somewhat more important
5	Much more important
7	Very much more important
9	Absolutely more important
2, 4, 6, 8	Intermediate values

QUALITIVE DATA

SCALE

- Observe that **we cannot have values lower than 1** – because it is axiomatically impossible to be "more equal" than "equal".

- In the same way, **we cannot have values higher than 9** – because it is impossible for an option to be more than absolutely important (hence, the meaning of "absolute").

- Intermediate values are used when decision-makers (DMs) need more granularity – and we could even use even more fine-grained distinctions (2.5, 7.893, etc), *albeit it comes with a lot of criticism*.

Intensity of importance	Definition
1	Equal importance
3	Somewhat more important
5	Much more important
7	Very much more important
9	Absolutely more important
2, 4, 6, 8	Intermediate values

- By defining a ratio between two criteria or alternatives (since in AHP an alternative and criterion are the same – only the alternative is the bottom level of the hierarchical architecture), the reciprocal is also valid:

- Eg.: Given two criteria a and b, and if a is 2x b, how much is 1 b in comparison to a? And a to a ?

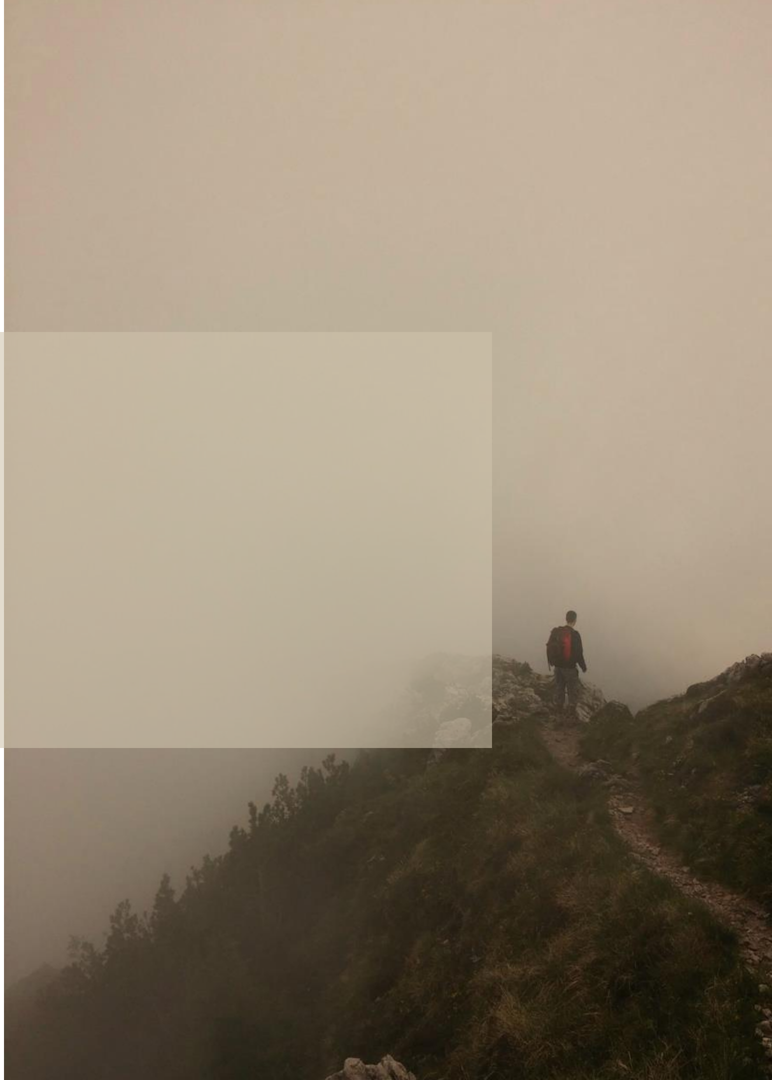
SCALE

- As such, we can define the basic properties of an AHP judgement matrix as:
- **1. A matrix with at least two criteria (otherwise it is a monocriterion decision and no MCDA is needed).**
- **2. The principal diagonal must always be 1 (as in $1a = 1a, 1b = 1b$, etc.).**
- **3. For each judgement n the reciprocal must be $^1/_n$.**
- $$\begin{array}{c} \\ a \\ b \\ c \end{array} \begin{array}{c} \begin{array}{ccc} a & b & c \end{array} \\ \begin{bmatrix} 1 & 2 & 4 \\ ? & 1 & 3 \\ ? & ? & 1 \end{bmatrix} \end{array} \rightarrow. \quad \begin{array}{c} \\ a \\ b \\ c \end{array} \begin{array}{c} \begin{array}{ccc} a & b & c \end{array} \\ \begin{bmatrix} 1 & 2 & ^1/_4 \\ ^1/_2 & 1 & 3 \\ 4 & ^1/_3 & 1 \end{bmatrix} \end{array}$$

Intensity of importance	Definition
1	Equal importance
3	Somewhat more important
5	Much more important
7	Very much more important
9	Absolutely more important
2, 4, 6, 8	Intermediate values

TWO MORE WAYS

- The classical AHP uses the **approximate eigenvector method**
- A common alternative is using **means** (geometric, fuzzy geometric, etc)
- Let's start with the classic one



APPROXIMATE EIGENVECTOR

APPROXIMATE EIGENVECTOR

- Instead of solving for the eigenvector using direct eigenvalue decomposition, we **square the pairwise comparison matrix repeatedly**. This **iteratively amplifies the dominant eigenvector**, which **stabilizes as the priority weights**.

- 1. Start with the Pairwise Comparison Matrix A.
  - Multiply A by itself (square it: A^2).
  - Normalize the rows (optional, for faster convergence).

- 2. Extract the Dominant Eigenvector
  - Take the sum of each row.
  - Normalize the vector by dividing each element by the sum of all elements.

- 3. Repeat Squaring Until Convergence
  - Square the matrix again.
  - Extract the new eigenvector.
  - Continue until the eigenvector stabilizes (i.e., the values do not change up to 4 decimal places).

APPROXIMATE EIGENVECTOR

APPROXIMATE EIGENVECTOR

- **Example: Choosing the Best Laptop (MacBook, Acer, Chromebook)**
- **Step 1: Define the Pairwise Comparison Matrix**
- We use five criteria:
  - 1. Battery Life (BL)
  - 2. Performance (PF)
  - 3. Price (PR)
  - 4. Durability (DU)
  - 5. Resale Value (RV)
- Pairwise comparison matrix (A) based on expert judgment:

$$A = \begin{bmatrix} 1 & 3 & 5 & 2 & 4 \\ 1/3 & 1 & 4 & 1/2 & 3 \\ 1/5 & 1/4 & 1 & 1/6 & 1/2 \\ 1/2 & 2 & 6 & 1 & 5 \\ 1/4 & 1/3 & 2 & 1/5 & 1 \end{bmatrix}$$

- Each value in row i, column j represents how much more important criterion i is compared to criterion j.

APPROXIMATE EIGENVECTOR

APPROXIMATE EIGENVECTOR

- **Step 2 – Square the matrix (A^2)**
- We compute $A^2 = A \times A$.

$$A^2 = \begin{bmatrix} 1 & 3 & 5 & 2 & 4 \\ 1/3 & 1 & 4 & 1/2 & 3 \\ 1/5 & 1/4 & 1 & 1/6 & 1/2 \\ 1/2 & 2 & 6 & 1 & 5 \\ 1/4 & 1/3 & 2 & 1/5 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 3 & 5 & 2 & 4 \\ 1/3 & 1 & 4 & 1/2 & 3 \\ 1/5 & 1/4 & 1 & 1/6 & 1/2 \\ 1/2 & 2 & 6 & 1 & 5 \\ 1/4 & 1/3 & 2 & 1/5 & 1 \end{bmatrix}$$

- This results in:

$$A^2 = \begin{bmatrix} 3.15 & 10.08 & 29.2 & 4.89 & 18.9 \\ 1.08 & 3.52 & 10.88 & 1.8 & 7.18 \\ 0.33 & 1.09 & 3.45 & 0.58 & 2.19 \\ 1.85 & 6.0 & 18.22 & 3.12 & 11.75 \\ 0.58 & 1.88 & 5.72 & 0.97 & 3.68 \end{bmatrix}$$

APPROXIMATE EIGENVECTOR

APPROXIMATE EIGENVECTOR

- **Step 3 – Extract the Priority Vector (Eigenvector)**
- Sum each row.

$$A^2 = \begin{bmatrix} 3.15 & 10.08 & 29.2 & 4.89 & 18.9 \\ 1.08 & 3.52 & 10.88 & 1.8 & 7.18 \\ 0.33 & 1.09 & 3.45 & 0.58 & 2.19 \\ 1.85 & 6.0 & 18.22 & 3.12 & 11.75 \\ 0.58 & 1.88 & 5.72 & 0.97 & 3.68 \end{bmatrix} \qquad S = \begin{bmatrix} 66.22 \\ 24.46 \\ 7.64 \\ 40.94 \\ 12.83 \end{bmatrix}$$

- Normalize by dividing each row sum by the total sum: $X_{\text{normalized},i} = \frac{X_i}{\sum X}$

$$w = \begin{bmatrix} \frac{66.22}{152.09} \\ \frac{24.46}{152.09} \\ \frac{7.64}{152.09} \\ \frac{40.94}{152.09} \\ \frac{12.83}{152.09} \end{bmatrix} \qquad w = \begin{bmatrix} 0.43 \\ 0.16 \\ 0.05 \\ 0.27 \\ 0.09 \end{bmatrix}$$

- This is the **priority vector** after the first squaring.

APPROXIMATE EIGENVECTOR

APPROXIMATE EIGENVECTOR

- **Step 4 - Repeat Squaring Until Convergence**
- Square the matrix again: $A^4 = A^2 \times A^2$.
  - Extract the new eigenvector.
  - Iterate until the values stabilize up to 4 decimal places.
- After further squaring, the final eigenvector stabilizes at:

$$w = \begin{bmatrix} 0.39 \\ 0.17 \\ 0.05 \\ 0.29 \\ 0.10 \end{bmatrix}$$

- This means:
  - Battery Life (0.39) is the most important
  - Durability (0.29) is the second most important
  - Performance (0.17) is moderately important
  - Resale Value (0.10) matters somewhat
  - Price (0.05) is the least important

APPROXIMATE EIGENVECTOR

Overview

- **1. We started with a comparison matrix**, where we rated how important each criterion was relative to the others.
- **2. We squared the matrix multiple times**, amplifying the dominant eigenvector.
- **3. After repeated squaring, the priority weights stabilized**, giving us the relative importance of each criterion.
- **4. These weights tell us what matters most** in choosing the best laptop.

- The original method uses eigenvalue calculation which is more precise, but computationally more expensive (lots of software options use it).
- For a classroom example or cases where the highest precision is not needed, we can use this approximate procedure (matrix squaring).

APPROXIMATE EIGENVECTOR

APPROXIMATE EIGENVECTOR

- Now let’s use this to evaluate the alternatives.
- We should to the same pairwise procedure criterion × criterion for each alternative (and do the same matrix squaring / eigenvector convergence)

Macbook	*Battery life*	*Performance*	*Price*	*Durability*	*Resale value*
Battery life	1				
Performance		1			
Price			1		
Durability				1	
Resale value					1

- But, for the sake of simplification here is a provided table with weights for all criteria × alternatives

Option / Crit	*Battery life*	*Performance*	*Price*	*Durability*	*Resale value*
Macbook	9	9	3	8	9
Acer	6	6	7	6	5
Chromebook	4	3	9	2	3

APPROXIMATE EIGENVECTOR

- Since we already have the weights of the criteria and now the weights...

Weight	*0.39*	*0.17*	*0.05*	*0.25*	*0.10*
Option / Crit	*Battery life*	*Performance*	*Price*	*Durability*	*Resale value*
Macbook	9	9	3	8	9
Acer	6	6	7	6	5
Chromebook	4	3	9	2	3

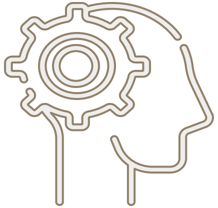
- ... we obtain the final scores (multiplying by priority weights):

$$\text{MacBook Score} = (9 \times 0.39) + (9 \times 0.17) + (3 \times 0.05) + (8 \times 0.29) + (9 \times 0.10) = 8.41$$

$$\text{Acer Score} = (6 \times 0.39) + (6 \times 0.17) + (7 \times 0.05) + (6 \times 0.29) + (5 \times 0.10) = 5.95$$

$$\text{Chromebook Score} = (4 \times 0.39) + (3 \times 0.17) + (9 \times 0.05) + (2 \times 0.29) + (3 \times 0.10) = 3.40$$

- **MacBook wins** with **8.41 points**, making it the best choice.



APPROXIMATE EIGENVECTOR

- What about “quantitative” data?
- In AHP, **quantitative criteria** can be **directly normalized instead of requiring pairwise comparisons**.

- Example – evaluate the best car using safety, reliability, and ***economy*** (km/l expenditure).
- For the first two criteria we use the Saaty Scale (1-9, reciprocals).

- For economy we obtain the real quantitative data

Car model	**km/l**
Celta	7.6
Honda Fit	11.8
Beetle	8

- And we normalize as before:

$$\text{Celta} = \frac{7.6000}{27.4000} = 0.2774$$

$$\text{Honda Fit} = \frac{11.8000}{27.4000} = 0.4307$$

$$\text{Beetle} = \frac{8.0000}{27.4000} = 0.2920$$

APPROXIMATE EIGENVECTOR

- Now, let's do an example in Google Sheets:

AHP

File Edit View Insert Format Data Tools Extensions Help

AHP - Version 1 (a.k.a. "Eigenvector method")

1 - Trade-offs between criteria

	Safety	Economy	Reliability
Safety	1.00	9.00	7.00
Economy	0.11	1.00	0.33
Reliability	0.14	3.00	1.00

2 - Squaring the matrix

	Safety	Economy	Reliability
Safety	3.00	39.00	17.00
Economy	0.27	3.00	1.44
Reliability	0.62	7.29	3.00

2.1 Add the lines to obtain eigenvector / normalize eigenvector

	Safety	Economy	Reliability	Eigenvector	Normalized Eig.
Safety	3.00	39.00	17.00	59.00	0.7907
Economy	0.27	3.00	1.44	4.71	0.0632
Reliability	0.62	7.29	3.00	10.90	0.1461
				74.62	

2.2 Square the matrix and repeat the process - check if the new eigenvector converges to 4 decimal places

	Safety	Economy	Reliability	Eigenvector	Normalized	
Safety	30.048	357.857	158.333	546.238	7.320	0.791
Economy	2.513	30.048	13.254	45.815	0.614	0.063
Reliability	5.680	67.857	30.048	103.585	1.388	0.146
				695.638		

MEAN METHOD

- In this version, we use a more simplified procedure based on means (I will provide and example with geometric means).

- 1. Start with the Pairwise Comparison Matrix A, as before.
- 2. Extract the (geometric) means of each row.
    - For each criterion, calculate:

$$GM_i = \left(\prod_{j=1}^{n} a_{ij} \right)^{1/n}$$

    - where a_{ij} is the pairwise comparison value for row i and column j, and n is the number of criteria.

$$GM_{Price} = (1 \times 1/3 \times 1/5)^{1/3} = (1/15)^{1/3} = 0.27$$

$$GM_{Battery} = (3 \times 1 \times 1/2)^{1/3} = (3/2)^{1/3} = 0.89$$

$$GM_{Performance} = (5 \times 2 \times 1)^{1/3} = (10)^{1/3} = 2.15$$

- 3. Normalize, as before:

$$w_{Price} = \frac{0.27}{(0.27 + 0.89 + 2.15)} = 0.08$$

$$w_{Battery} = \frac{0.89}{(0.27 + 0.89 + 2.15)} = 0.26$$

$$w_{Performance} = \frac{2.15}{(0.27 + 0.89 + 2.15)} = 0.66$$

- 4. As before, multiply alternative scores by these weights to determine the best choice.

MEAN METHOD

MEAN METHOD

Overview

- **1. We started with a comparison matrix**, where we rated how important each criterion was relative to the others.
- **2. We computed the geometric means of rows and normalized**, obtaining a ratio value.
- **4. These weights tell us what matters most** in choosing the best car.

- There is some room for experimentation here (some variants use other simple average instead of geometric means, for instance).

MEAN METHOD

MEAN METHOD

- Now, let’s do an example in Google Sheets (I already pre-made all formulae):

AHP

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S10

	A	B	C	D	E	F	G
1							
2			1	2	3	4	5
3		Description	A	B	C	D	E
4	1	A	1.0000	2.0000	4.0000		
5	2	B	0.5000	1.0000	2.5000		
6	3	C	0.2500	0.4000	1.0000		
7	4	D					
8	5	E					
9	6	F					
10	7	G					
11	8	H					
12	9	I					
13	10	J					
14	11	K					
15	12	L					
16	13	M					
17	14	N					
18	15	O					
19		SUM	1.750	3.400	7.500		
20							
21							
22							
23			1	2	3	4	5
24		Description	A	B	C	D	E
25	1	A	0.5714	0.5882	0.5333		
26	2	B	0.2857	0.2941	0.3333		
27	3	C	0.1429	0.1176	0.1333		
28	4	D					
29	5	E					
30	6	F					
31	7	G					

MEAN METHOD

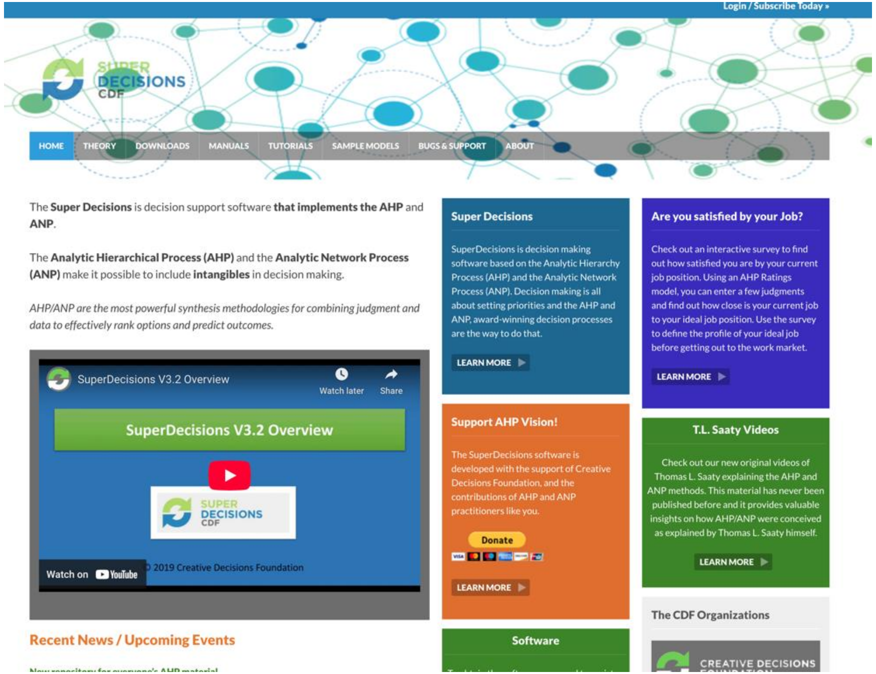
SUPER DECISIONS TUTORIAL

Automating it all in a simple yet useful software

SUPERDECISIONS

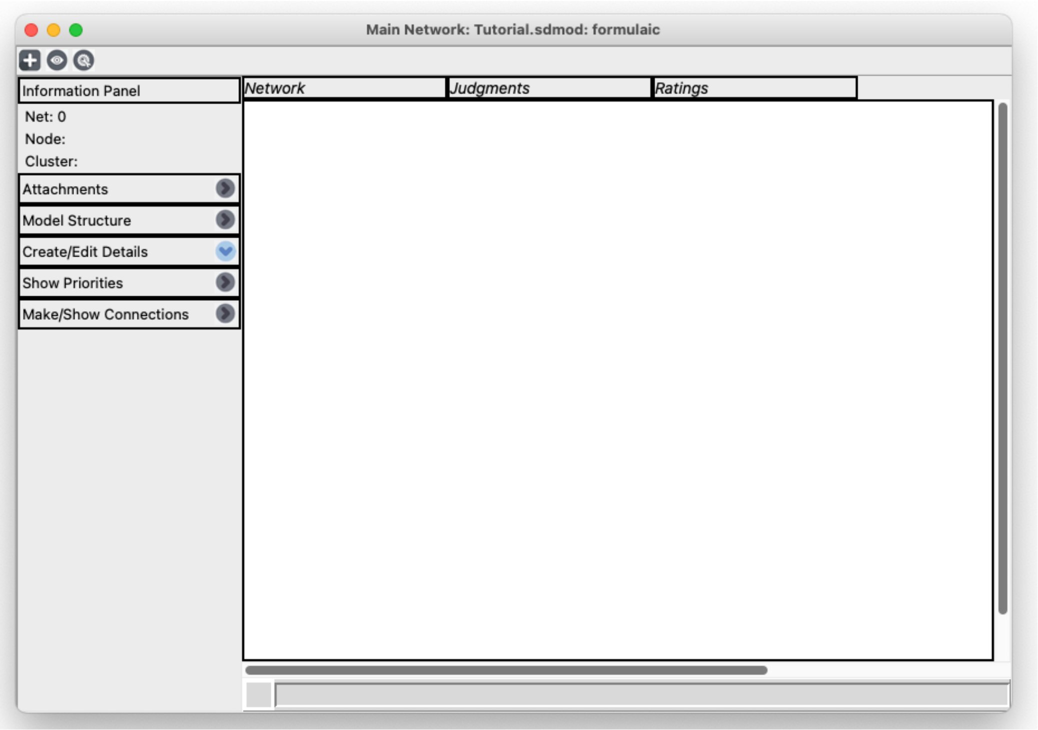
SuperDecisions

- Free software to use in AHP / ANP models
- Login / subscribe → create account
- After login → Downloads
- Today we are following the first tutorial for **version V3.X**



SuperDecisions 01

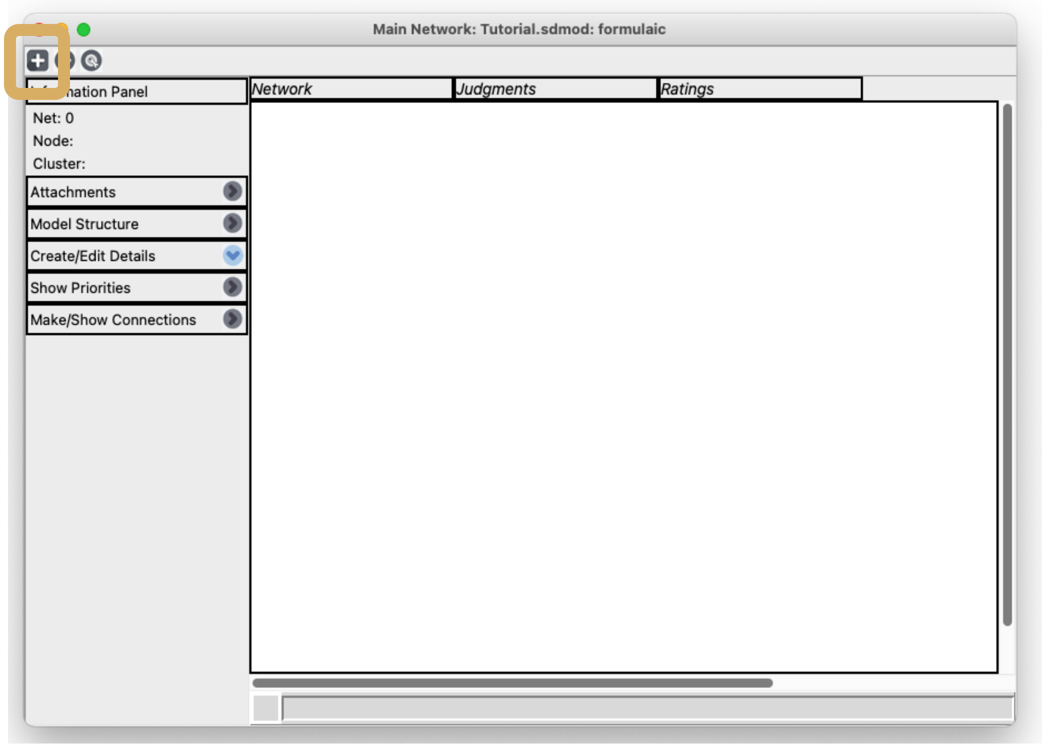
- Open SuperDecisions
- **Menu file → New; Save the new model with a name / folder**
- **Suggestion:** create a folder for the course and save your models there.



SUPERDECISIONS

SuperDecisions 02

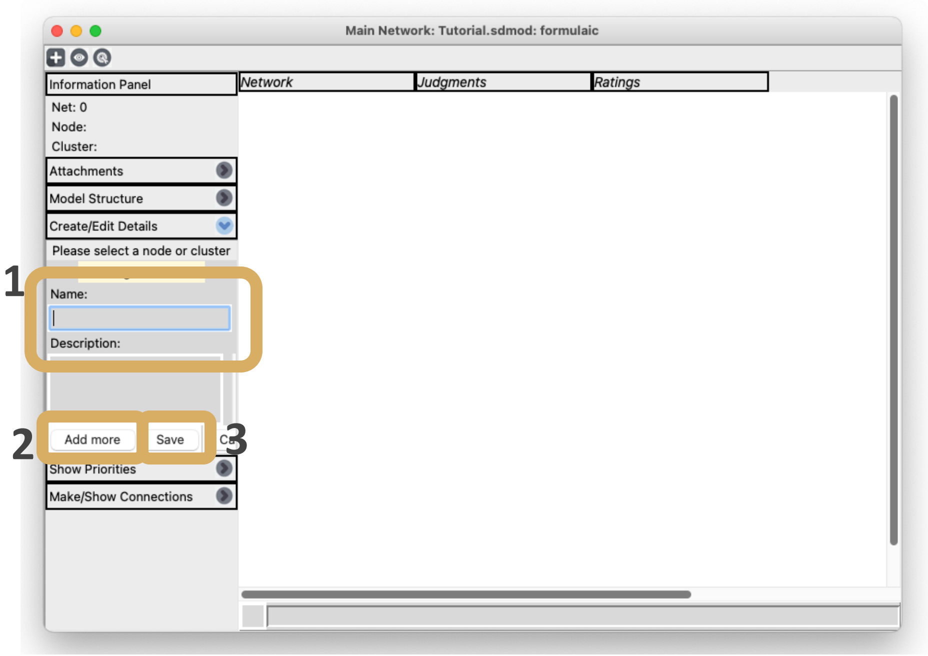
- We start by creating nodes – nodes in SuperDecisions are levels in an AHP model



SUPERDECISIONS

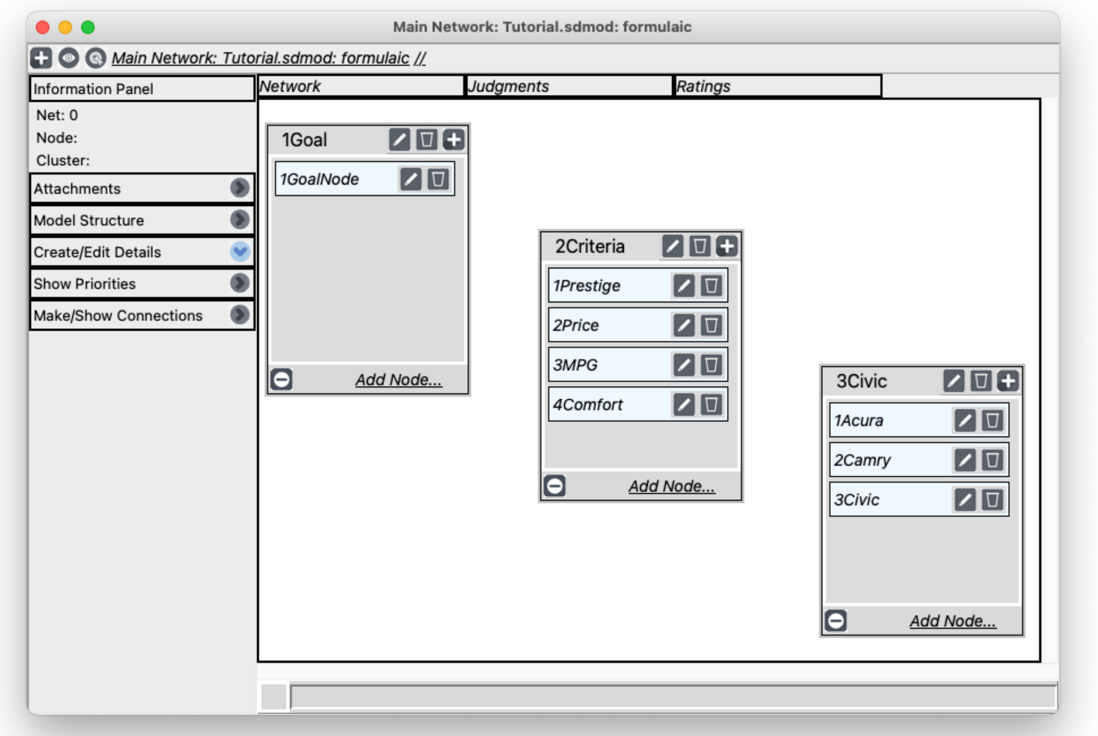
SuperDecisions 03

- We start by creating nodes – nodes in SuperDecisions are levels in an AHP model
- Name your nodes (1) and to create other nodes use “add more” (2), or save (3).
- Tip: Add numbers to nodes as SuperDecisions is very bad at ordering nodes / alternatives.
- **Eg.: 1Goal; 2Criteria; 3Alternatives**



SuperDecisions 04

- You can rearrange the nodes
- You cannot connect nodes (boxes) without at least one component (node) (1)
- Create the following criteria and alternatives

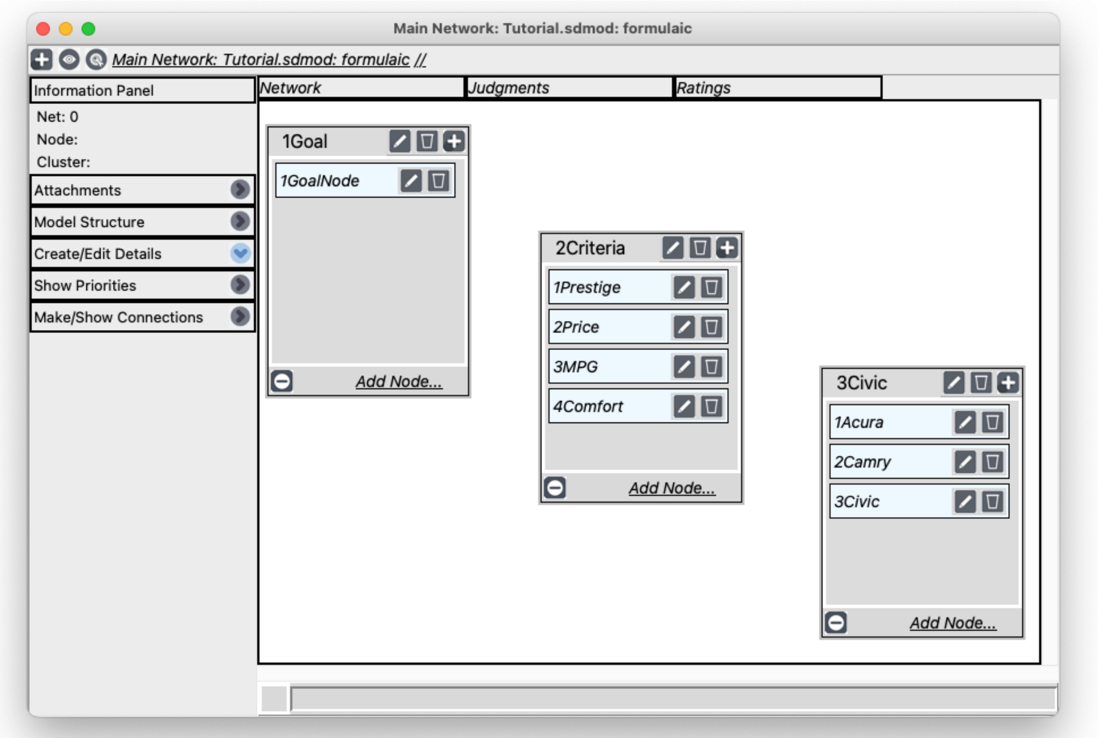


SUPERDECISIONS

SUPERDECISIONS

SuperDecisions 05

- You can rearrange the nodes
- You cannot connect nodes (boxes) without at least one component (node) (1)
- Create the following criteria and alternatives

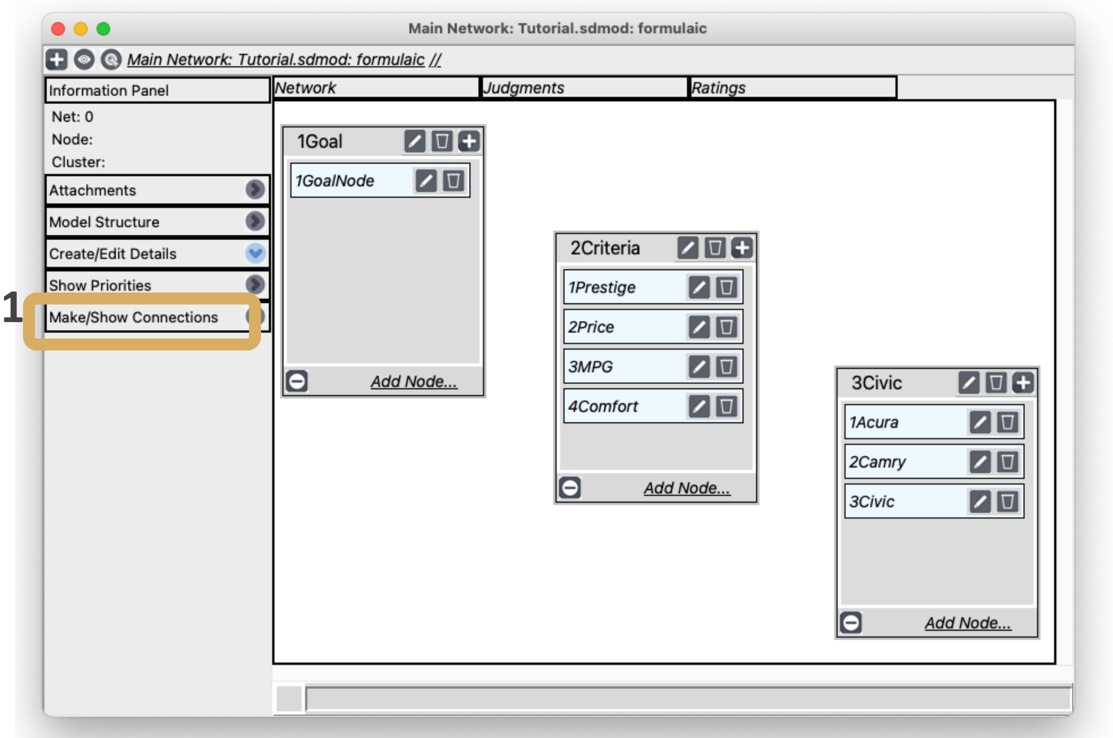


SUPERDECISIONS

SuperDecisions 06

- At least in the Mac version, it is very buggy – save frequently!!
- For each node you can edit it (pen symbol), delete it (bin symbol), add a node (plus symbol) or minimize it (minus symbol)
- To connect levels, click the one you want and press “Make/Show Connections” (1)

1

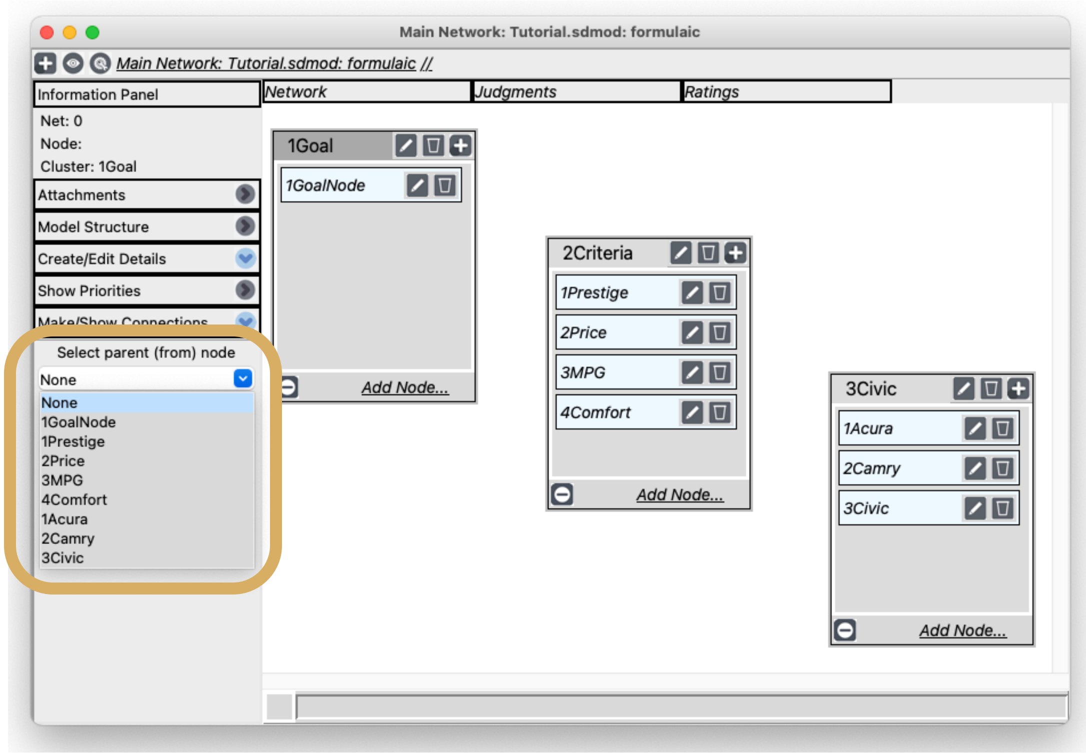


SUPERDECISIONS

SuperDecisions 07

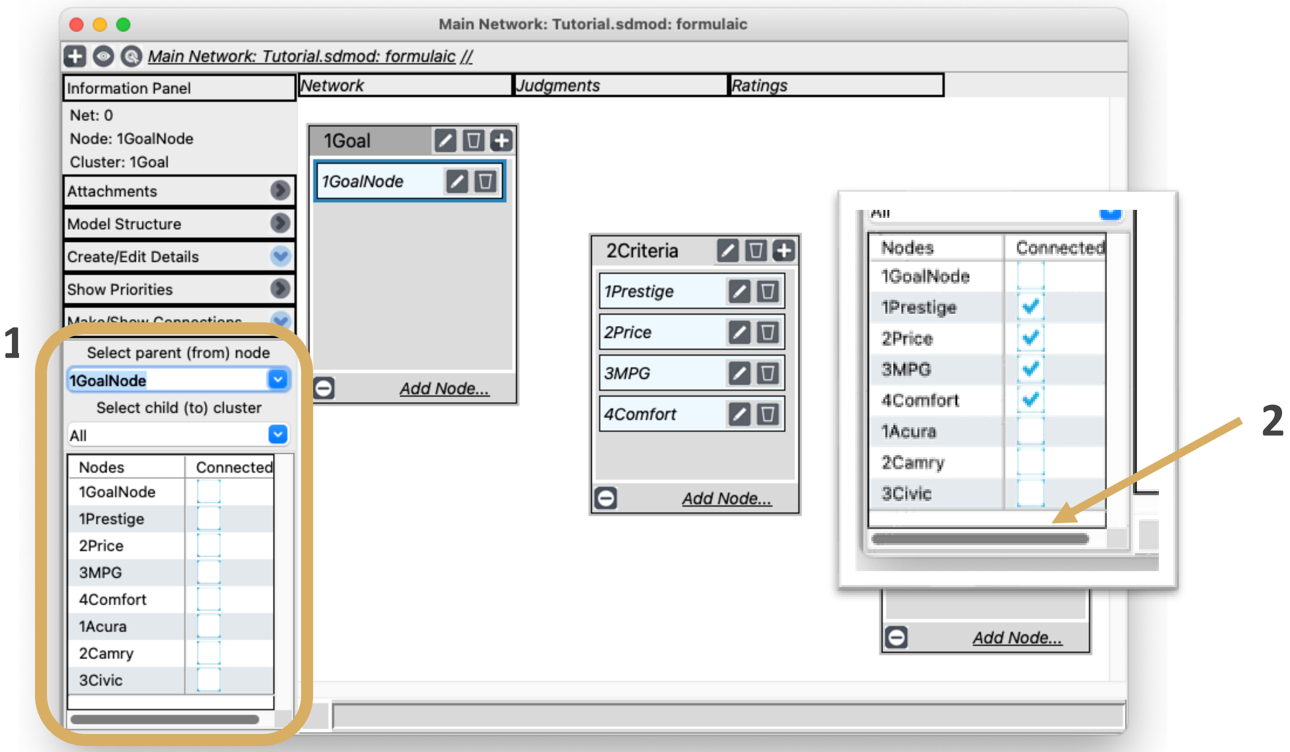
- Since AHP is a hierarchical model, you need to connect from parents (from) to children nodes (to)

1



SuperDecisions 08

- Now connect to the child node
- Warning: You need to click the white space below the nodes after selecting the last node otherwise it won’t be saved (2).

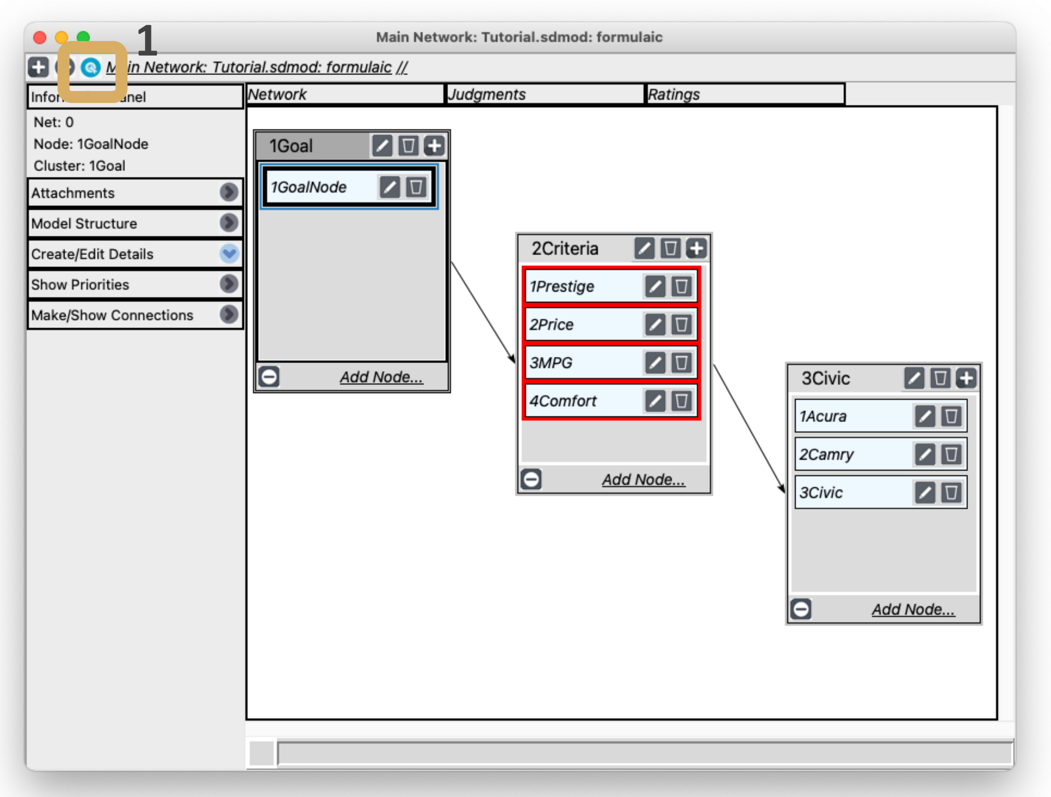


SUPERDECISIONS

SUPERDECISIONS

SuperDecisions 09

- Enable the “show connections” mode and check if all connections are correct.
- If you created a loop, right click the node and press “Remove self loop”



SuperDecisions 10

- Check if all options are correct in Computations → Unweighted Supermatrix → Graphical
- Now you understand why add numbers to nodes
- Notice that all weights are equally distributed (it will change when you input judgements)
- The same for the alternatives

Main Network: Tutorial.sdmod: formulaic: Unweighted Super Matrix

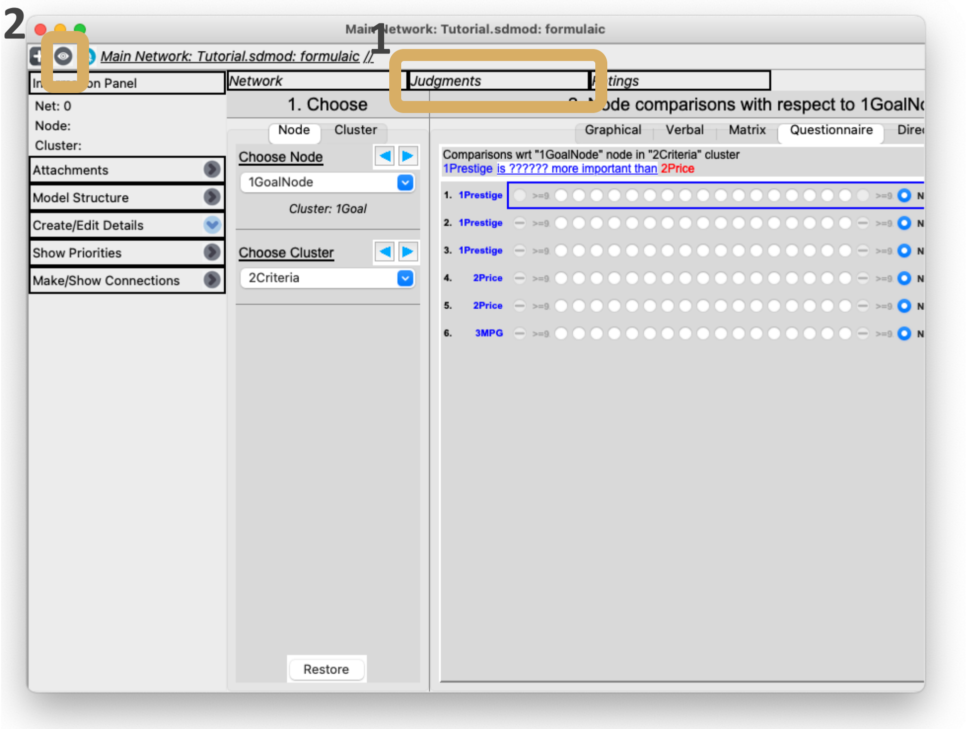
Clusters	Nodes	1GoalNode	1Prestige	2Price	3MPG	4Comfort	1Acura	2Camry	3Civic
1Goal	1GoalNode	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2Criteria	1Prestige	0.250000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	2Price	0.250000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	3MPG	0.250000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	4Comfort	0.250000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3Civic	1Acura	0.000000	0.333333	0.333333	0.333333	0.333333	0.000000	0.000000	0.000000
	2Camry	0.000000	0.333333	0.333333	0.333333	0.333333	0.000000	0.000000	0.000000
	3Civic	0.000000	0.333333	0.333333	0.333333	0.333333	0.000000	0.000000	0.000000

Done

SUPERDECISIONS

SuperDecisions 11

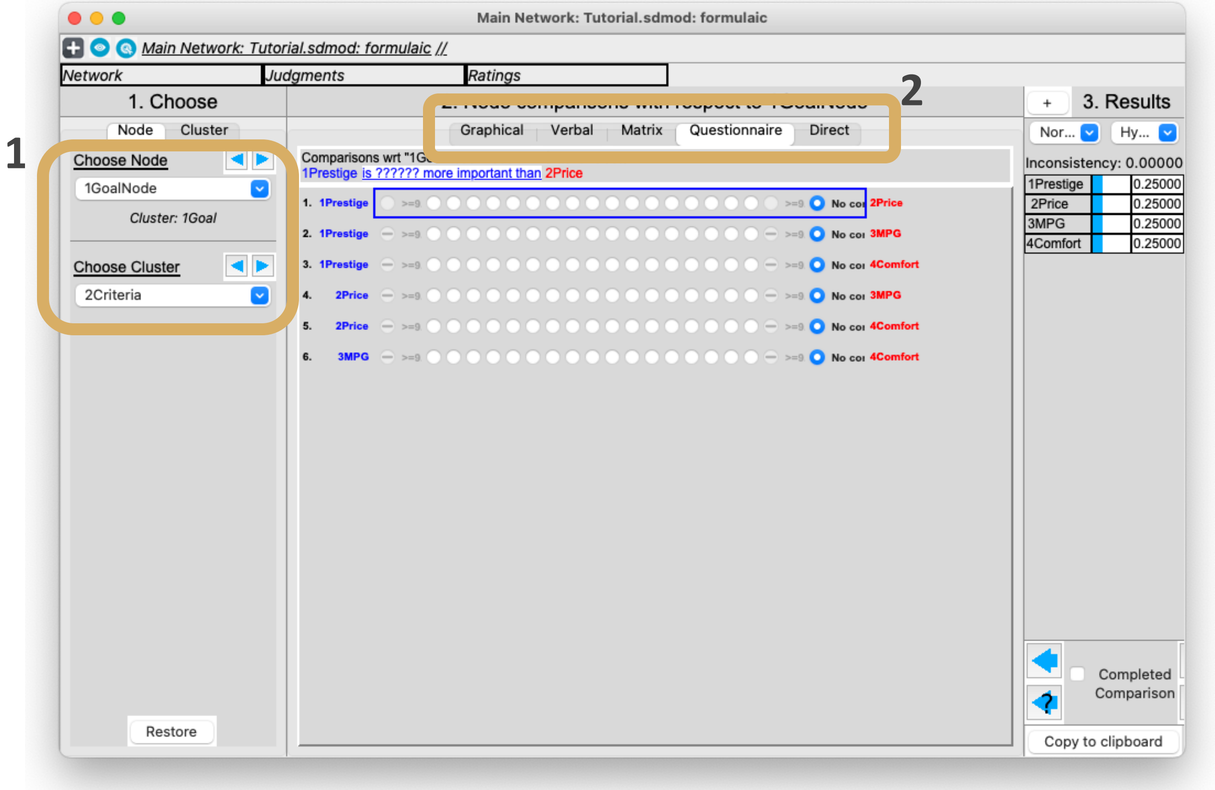
- To input judgement, use the “Judgements” panel (1)
- You can hide the information panel to gain more viewing space (2)



SUPERDECISIONS

SuperDecisions 12

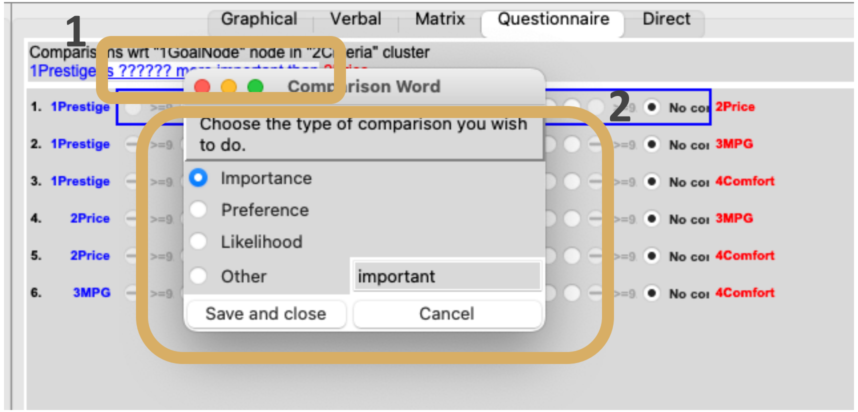
- We are going to input judgments by levels (nodes) (1)
- Let’s explore the modes (2)

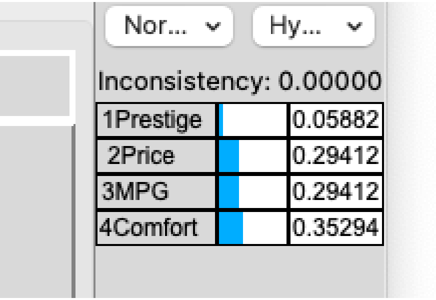


SUPERDECISIONS

SuperDecisions 13

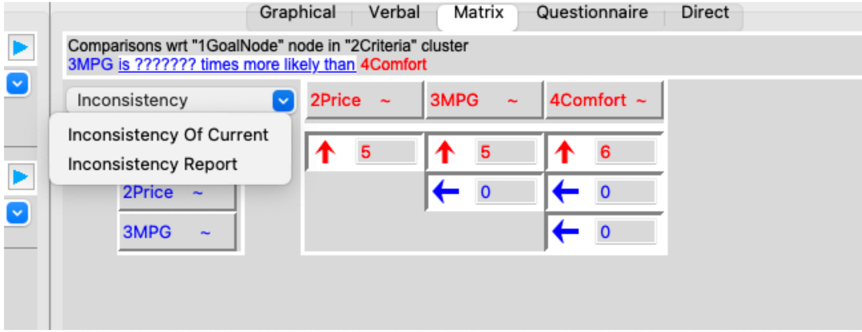
- By clicking on the “is ???? More important” you can change the phrasing
- The inconsistency level is updated each time you input new information (try to keep it under 0.1)





SuperDecisions 14

- You check the inconsistencies on Matrix → Inconsistency → Inconsistency report
- Here the ranking is from the most inconsistent onwards
- Change the values according to the suggestions (or not!) and check it again.



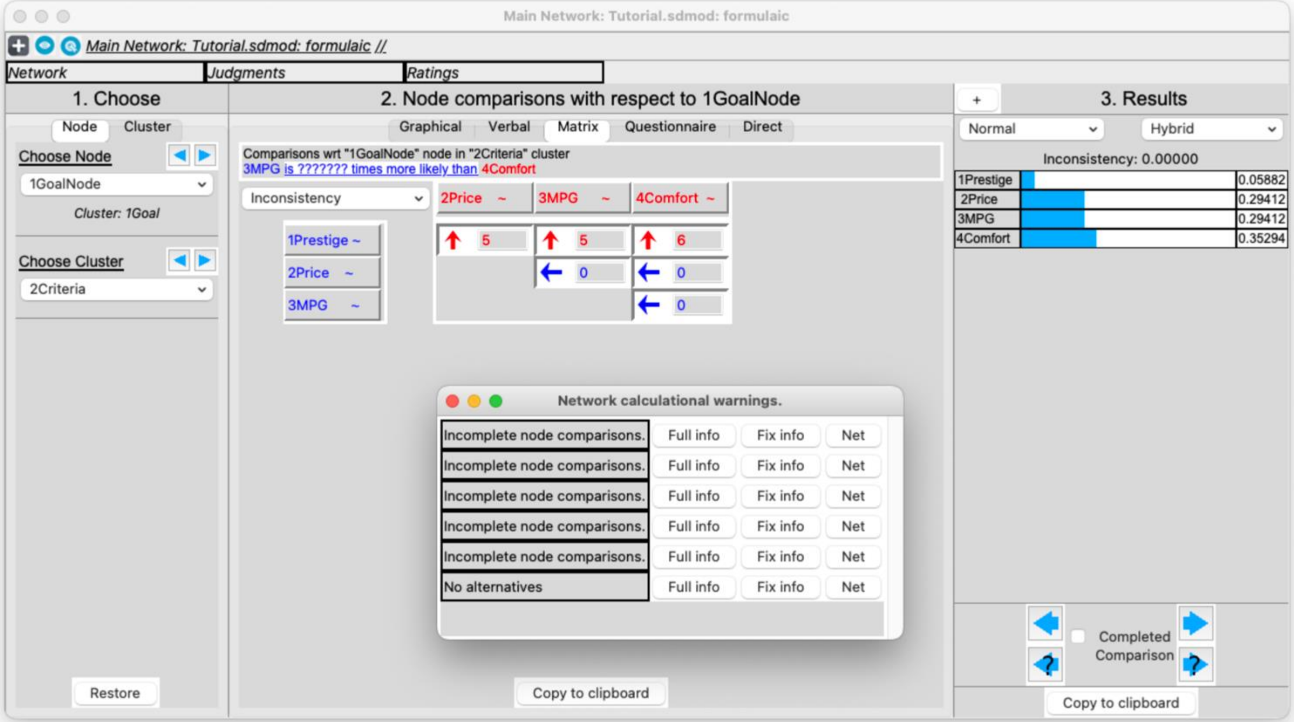
Inconsistency Report

Rank	Row	Col	Current Val	Best Val	Old Inconsist.	New Inconsist.	% Improvement
1.	1Prestige	4Comfort	6.000000	2.142857	9.449353e-11	5.687336e-12	NA
2.	2Price	3MPG	0.000000	1.000000	9.449353e-11	9.449353e-11	NA
3.	2Price	4Comfort	0.000000	1.200000	9.449353e-11	9.449353e-11	NA
4.	3MPG	4Comfort	0.000000	1.200000	9.449353e-11	9.449353e-11	NA
5.	1Prestige	2Price	5.000000	2.195122	9.449353e-11	9.729446e-11	NA
6.	1Prestige	3MPG	5.000000	2.195122	9.449353e-11	9.729446e-11	NA

SUPERDECISIONS

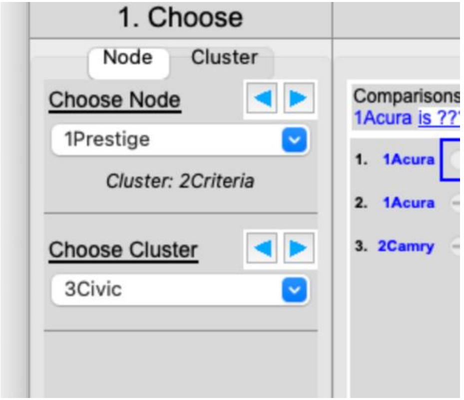
SuperDecisions 15

- Check if you have entered all criteria and alternatives in Computations → Sanity Check



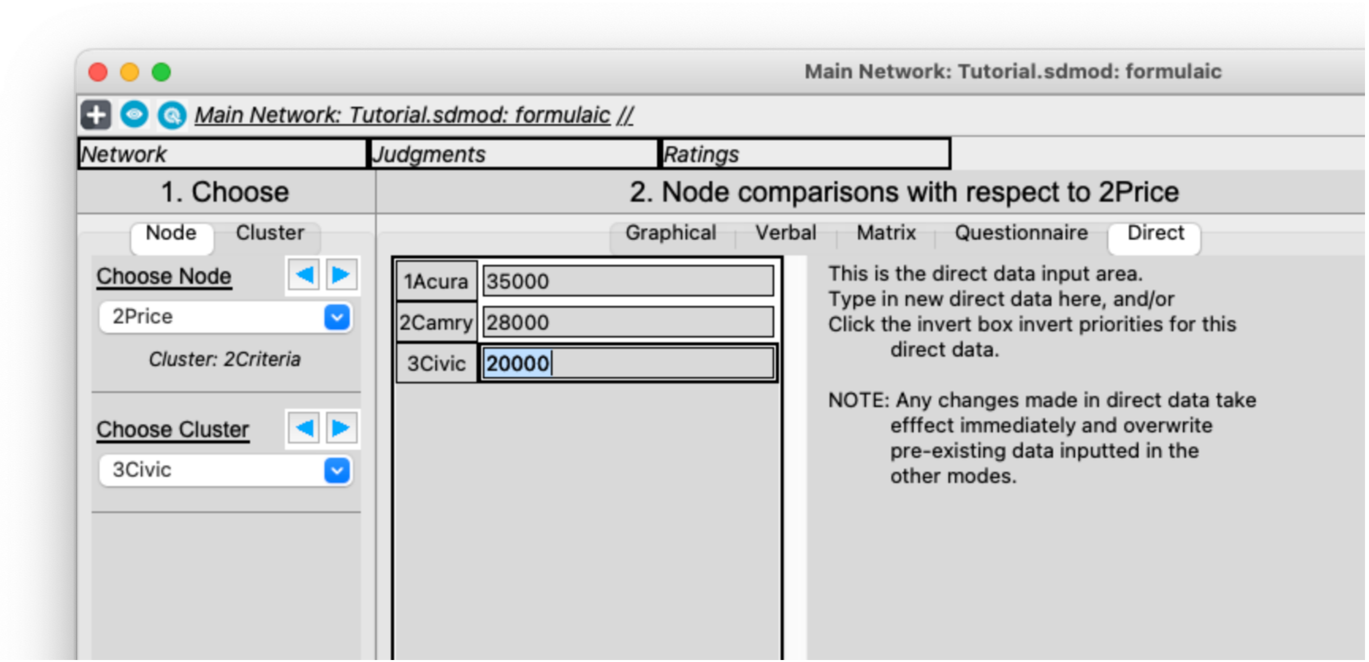
SuperDecisions 16

- Do the same for the subsequent levels



SuperDecisions 17

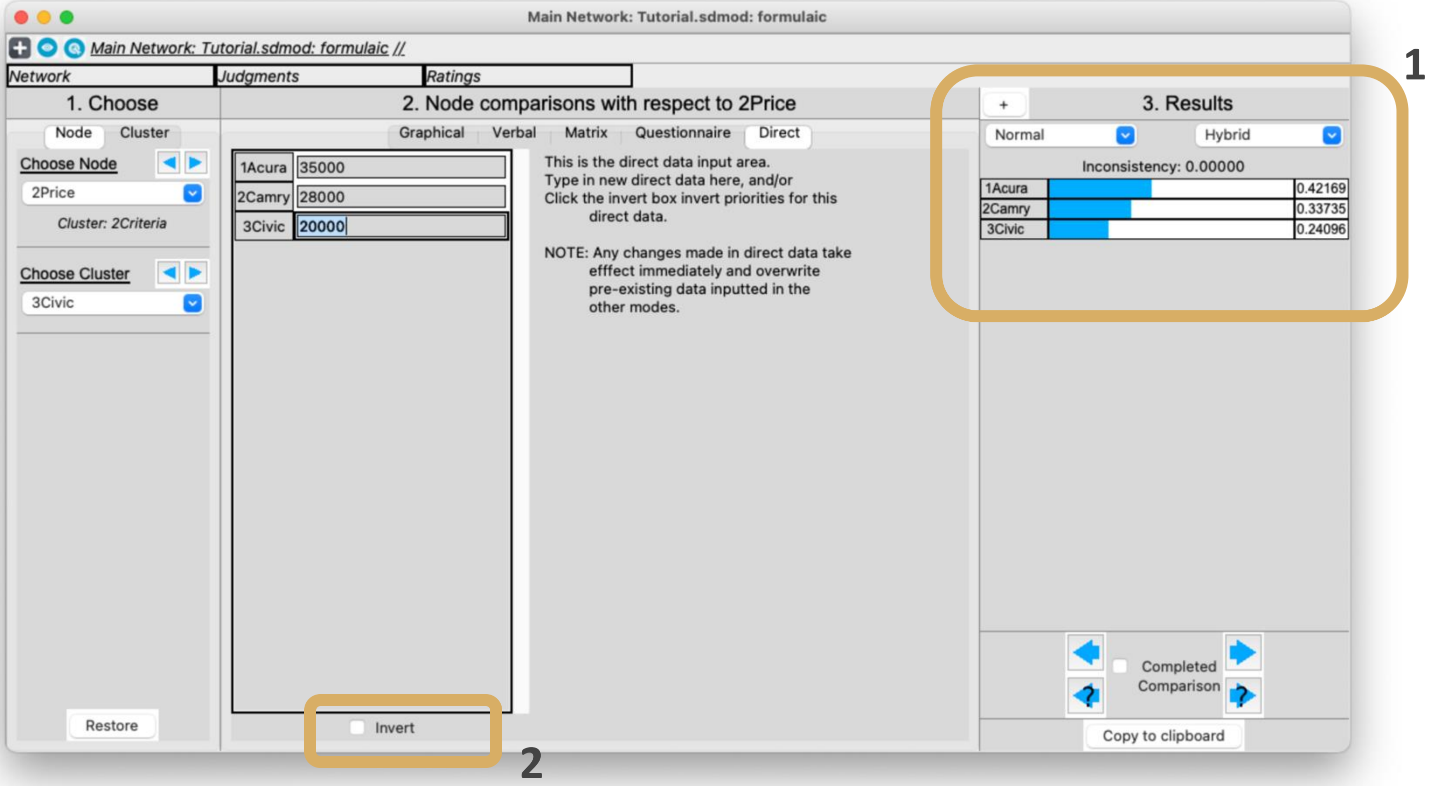
- Price is a nice example to input raw data instead of judgements (direct comparison)



SUPERDECISIONS

SuperDecisions 18

- As in price lower is better (1), we can invert the scale so it aligns with our judgement (2)
- After inputting all the judgements, remember to save the model.



SUPERDECISIONS

SuperDecisions 19

- As for the results let’s start with the Unweighted Super Matrix

Main Network: Tutorial.sdmod: formulaic: Unweighted Super Matrix

Clusters	Nodes	1GoalNode	1Prestige	2Price	3MPG	4Comfort	1Acura	2Camry	3Civic
1Goal	1GoalNode	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2Criteria	1Prestige	0.055527	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	2Price	0.308581	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	3MPG	0.255844	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	4Comfort	0.380049	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3Civic	1Acura	0.000000	0.658630	0.250000	0.281690	0.333333	0.000000	0.000000	0.000000
	2Camry	0.000000	0.262753	0.312500	0.309859	0.333333	0.000000	0.000000	0.000000
	3Civic	0.000000	0.078617	0.437500	0.408451	0.333333	0.000000	0.000000	0.000000

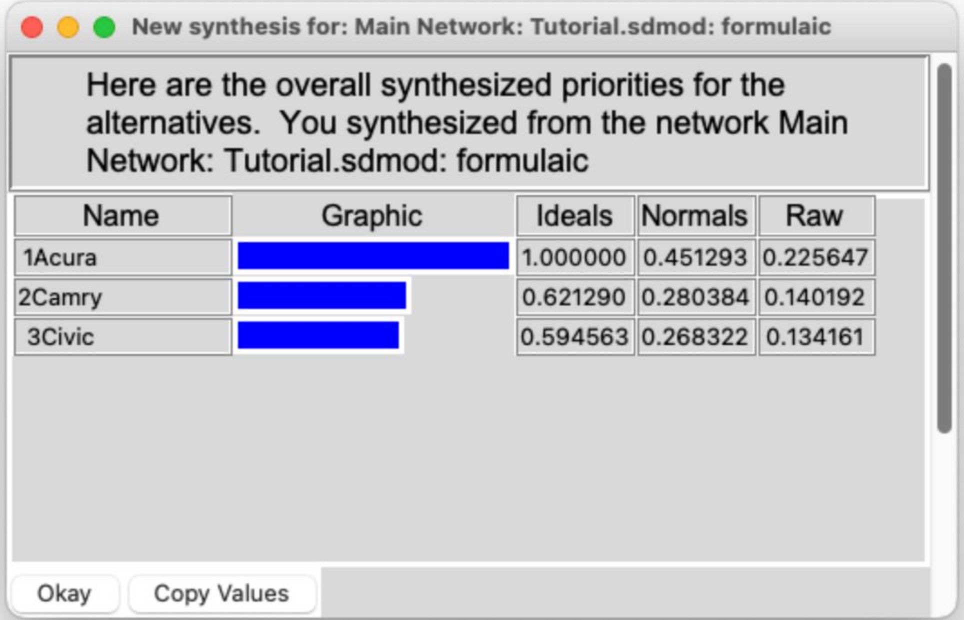
Done

SUPERDECISIONS

SUPERDECISIONS

SuperDecisions 20

- To get the ranked alternatives and weights use Computations → Synthesize
- Remember to name the alternatives 3Alternatives to ensure this option works well



Name	Graphic	Ideals	Normals	Raw
1Acura		1.000000	0.451293	0.225647
2Camry		0.621290	0.280384	0.140192
3Civic		0.594563	0.268322	0.134161

TIMELINE

Subject to change

03

Analytical Hierarchical Process (AHP)

04

Fuzzy AHP and TOPSIS

05

MACBETH

PAPRIKA

Nothing to do with cooking, unfortunately

REFERENCES

REFERENCES

Today's content was mainly based on

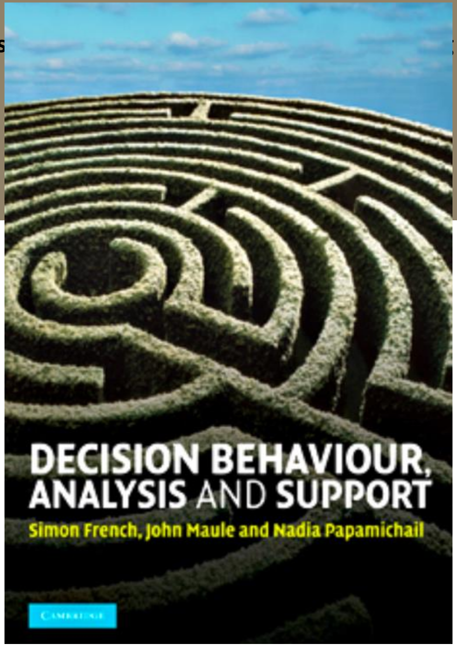
- **Goodwin, P., & Wright, G. (2014). Decision analysis for management judgment. John Wiley & Sons.**
  Belton, V., & Stewart, T. (2012). Multiple criteria decision analysis: an integrated approach. Springer Science & Business Media.
- **Greco, S., Figueira, J., & Ehrgott, M. (Eds.). (2016). Multiple criteria decision analysis: state of the art surveys. New York, Springer.**
- **Forman, E. H., & Selly, M. A. (2001). Decision by objectives: how to convince others that you are right. World Scientific.**

REFERENCES

RECOMMENDATION

Today’s content was mainly based on

- **Goodwin, P., & Wright, G. (2014). Decision analysis for management judgment. John Wiley & Sons. Belton, V., & Stewart, T. (2012). Multiple criteria decision analysis: an integrated approach. Springer Science & Business Media.**
- **Greco, S., Figueira, J., & Ehrgott, M. (Eds.). (2016). Multiple criteria decision analysis: state of the art surveys. New York, Springer.**
- **Forman, E. H., & Selly, M. A. (2001). Decision by objectives ... ht. World Scientific.**



THANKS

Does anyone have any questions?
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