

Methods and Tools for Achieving Sustainability

Decision Problem Formulation and Structuring using Cognitive Modeling

Looking for actual decision criteria and alternatives

The screenshot displays the eCASS software interface, which is used for cognitive modeling. The main window shows a model titled "Model: Flooding" with a central node "damage(3.0)" in red. Other nodes include "water(1.0)", "levee(2.0)", "property(4.0)", "insurance(3.0)", "flood(3.0)", "contamination(2.0)", and "ecology(1.0)". Relationships are indicated by arrows, such as "cause(1.0)", "support(1.0)", and "cause(3.0)".

The interface includes several panels:

- Models:** A list of models, with "Flooding" selected.
- Variables:** A list of variables, including "damage", "flood", "levee", "health", "insurance", "government", and "water".
- Relationships:** A list of relationships, including "cause", "illustrate", "cover", "responsible", "support", "developed", and "affect".
- Properties: Flooding:** A table with the following data:

General	
Type	Model
Author	
Date	
Name	Flooding
Description	
Weight	
Weight	1
- Notes: Flooding:** A text area containing the following text:

A flood causes damage of property. Insurance for property should cover a property damage. The damage of property causes contamination of water. The government can support insurance. The contamination affects health and ecology. The insurance can cover health also. Bigger floods cause bigger damage. This example was developed to illustrate software functionality. The flood can cause damage of the levees. The government is responsible for levees.

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Decision Problem Formulation and Structuring using Cognitive Coding

Reading between lines getting into somebody's mind

The screenshot displays a software interface for cognitive coding, with a central document window and several side panels. The document window shows three numbered questions (7, 8, and 9) with associated text and highlighted code labels. The 'Codes' panel on the left shows a hierarchical tree of codes, including 'General Codes' and 'Keywords and Qualifiers'. The 'Cohorts' panel at the bottom left shows a list of cohorts. The 'Properties - q4' panel on the right shows metadata for a specific question, including 'Name', 'Cohort', 'Text', 'Author', 'Date', 'Keywords', and 'Relevance'. The 'WordCloud' panel on the right shows a word cloud of terms extracted from the document, with 'machinery (8)' being the most prominent word. Other words include 'questions (3)', 'training (3)', 'mentioned (2)', 'transport (3)', 'adoption (1)', 'team (3)', 'working (1)', 'help (1)', 'significantly (1)', 'reduce (1)', and 'accidents (4)'. The interface also includes a menu bar (File, Edit, View, Tools) and a toolbar with various icons for document manipulation.

Document - CODED Coal / Decision-Maker Example Interview Piece

7. Of all the things about mobile machinery that you have mentioned, what do you think is the number one issue that should be addressed? Can you tell me why you think it is the number one issue?

need:behaviour q

need:buy-in

need:tech I think it all goes back to behaviour. How do you change the mindset of people? We can't have all these fancy equipment and systems installed, but if we can't change the people's attitudes then we will get nowhere. We need the operator to fill in his pre-check list on his equipment. If it is faulty, then he must park his machine. We however still would find an operator using a shuttle car while his BOOYCE (Proximity detection system) is faulty. It is that mindset that we need to change. q8

8. What do you think should be done to address this issue to prevent mobile machinery accidents?

need:buy-in q

need:behaviour

need:tech I think we need to get the buy-in from the actual level of the operators. I think it is also about coming back and changing a culture. I mean... If we have head office visits underground, everybody's BOOYCO lamp is flashing, everyone is happy - We are however standing where we are not supposed to stand. We all need to get into the mindset that if your lamp is flashing then you need to move away from the danger zone. The systems are there to protect us, but our mindsets must be right. I also think that we can improve on the system. We have done a lot of work with the OEM, but I think that there is still a lot of work to be done. Continuous improvement

[skipped questions here as well]

Properties - q4

General	
Type	Tag
Name	q4
Cohort	Cohort
Text	
Author	
Date	
Keywords	
Relevance	100%

WordCloud

questions (3) eliminated (1)

training (3) sample (1)

mentioned (2) mosh (1)

transport (3)

machinery (8)

adoption (1) team (3) working (1) help (1)

significantly (1) reduce (1)

accidents (4) cause (1) injury (1)

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Using Cognitive Analysis in Expert Systems

CHEMM

Chemical Expert System

Add User

Id	Name	About	e-mail	Password	Admin	User	Role	Edit	Delete
1	Mike	mike	mike	Yes	civilian			Edit	Delete
2	John	john	john	No	fireman			Edit	Delete
3	Steve	steve	steve	No	paramedic			Edit	Delete
4	Lolly	lolly	lolly	Yes	fireman			Edit	Delete
7	David	david	david	No	Policeman			Edit	Delete
8	Mark	mark	mark	No	surgeon			Edit	Delete
9	Admin	admin	admin	Yes	civilian			Edit	Delete
10	kevin	kevin	kevin	No	EMT			Edit	Delete
11	mark	mark	mark	No	HMT			Edit	Delete

Back

Home

Contact Us

Hello, Mike.

That's your admin page.

Users

Roles

Mental Models

CHEMM

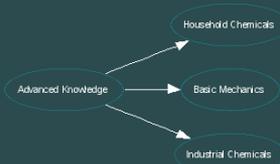
Chemical Expert System

Mental Model

Name paramedic

Description somebody with good medical knowledge

Add Node



MM Nodes

Name	Description	Weight	Edit	Delete
Advanced Knowledge		25	Edit	Delete
Household Chemicals		1	Edit	Delete
Basic Mechanics		2	Edit	Delete
Industrial Chemicals		1	Edit	Delete

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CHEMM

Chemical Expert System

Hello, Steve.

That's your personal page.

Name Steve

About

e-mail steve

User Role paramedic

Questions

- Advanced Symptoms
- General Symptoms
- Blood Tests
- Color of Substance
- pH of Substance
- State of Substance
- Scent of Substance

Advanced Symptoms

- Hepatic Failure
- Internal Hemorrhage
- Pulmonary Edema

Submit

Scenarios

Surveys

Questions

Chemicals

Actions

Exit

Home

Contact Us

Exit

CHEMM

Chemical Expert System

Possible Chemicals

CAS	Name	Description	KOW	KOC	CSF	RFD
12789-03-8	Chlordane		6.16	6.08	0.35	0.0005

Necessary actions

Action	Description
Do not Induce Vomiting (Chlordane)	
Examination (Chlordane)	
Lots of Water to Drink (Chlordane)	
Removing Source of Poisoning (Chlordane)	

Take a new Scenario

Home

Contact Us

Exit

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Decision Making using Advanced Multiple Criteria Decision Making

Taking into account multiple scenarios and factors

D:\Backup\Work_11.02.11\ERDC\CBRN4DHS\taurus\data\simple.xml

File Edit View Tools Help

New Open Save Calculate Rebuild

Countermeasures

- Alternatives
 - Prevention
 - Remediation
- Criteria
 - Cost
- Targets
 - Airport
 - Threats
 - Chemical
 - Averted_casualties
 - Biological
 - Averted_casualties
 - Hotel
 - Threats
 - Chemical
 - Averted_casualties
 - Biological
 - Averted_casualties

Countermeasures						
	0.3	0.7				
Cost		Targets				
		0.585600000000000001		0.104560000000000001		
		Airport		Hotel		
		0.8		0.8		
		Threats		Threats		
		0.31	0.580000000000000001	0.31	0.580000000000000001	
		Chemical	Biological	Chemical	Biological	
		1.0	1.0	1.0	1.0	
		Averted_casualties	Averted_casualties	Averted_casualties	Averted_casualties	
Prevention	900.0	0.0	0.0	0.0	0.0	0.0300
Remediation	400.0	0.0	0.0	0.0	0.0	0.180

Prevention 900.0 0.0 0.0 0.0 0.0 0.0300

Remediation 400.0 0.0 0.0 0.0 0.0 0.0 0.180

Aggregation Expression:
c0+c1+c2+c3+c4

Class	ModelCriterion
Name	Countermeasures
Full Name	Countermeasures
Weight	1.0
Scores	[0.3, 0.7]
Leaf Criteria	[Cost,Averted_casualties]
Dependency Matrix	[[false,false,false,false,f
Aggregation Expression	c0+c1+c2+c3+c4
Use Custom Expression	false
Custom Expression	

Prevention 0.03

Remediation 0.18

Methods and Tools for Achieving Sustainability

Integrating Risk Assessment Model into Decision Making

Contaminated sediments risk assessment

The screenshot shows the BRA software interface with the following components:

- Explorer:** A tree view showing the project structure under 'TTModel', including categories like Invertebrates, Fishes, Birds, Mammals, Human, Chemicals, and Sites. The 'Ep Inv SHLF' folder is selected.
- Table:** A table with columns: Name, Site, Lipid, and Diet Pathway. The table contains data for various invertebrates and their associated sites and lipid/diet pathways.
- Properties:** A panel showing the properties of the selected item, 'Ep Inv SHLF', including Type (Invertebrate), Name (Ep Inv SHLF), Site (Head of Canyon), Lipid (0.98; 1.2; 2.88; 1.6), and Diet Pathway (SEDIMENT).

Name	Site	Lipid	Diet Pathway
Inf Inv SHLF	Harbor	0.98; 1.24; 1.88; 2.74	SEDIMENT
Plankton HBR	Canyon Slope	0.98; 1.24; 1.88; 2.74	WATER
Plankton HC...	Continental Shelf	0.98; 1.24; 1.88; 2.74	WATER
Inf Inv CNYN	Harbor	0.98; 1.24; 1.88; 2.74	SEDIMENT
Ep Inv CNYN	Harbor	2.8; 1.2; 2.88; 1.6	SEDIMENT
Ep Inv SHLF	Head of Canyon	0.98; 1.2; 2.88; 1.6	SEDIMENT
Ep Inv HCNYN	Continental Shelf	0.98; 1.2; 2.88; 1.6	SEDIMENT
Plankton NSHR	Continental Shelf	2.8; 1.2; 2.88; 1.6	SEDIMENT
Ep Inv NSHR	Continental Shelf	2.8; 1.2; 2.88; 1.6	SEDIMENT
Inf Inv HBR	Harbor	0.98; 1.24; 1.88; 2.74	SEDIMENT

The screenshot shows the BRA software interface with the following components:

- Explorer:** A tree view showing the project structure under 'TTModel', including categories like Invertebrates, Fishes, Birds, Mammals, Human, Chemicals, and Sites. The 'Birds' folder is selected, and 'Heron...' is highlighted.
- Table:** A table with columns: Name, Site, Body Weight, Ingestion Rate, and Migration Factor. The table contains data for various birds and their associated sites and body weights.
- Properties:** A panel showing the properties of the selected item, 'Heron NSHR', including Type (Bird), Name (Heron NSHR), Site (Head of Canyon), Body Weight (1.9; 3.0; 2.09; 3.0), Ingestion Rate (0.3), Migration Factor (0.1), and Bird Diet (0).

Name	Site	Body Weight	Ingestion Rate	Migration Factor
Turnstone NSHR	Head of Canyon	2.9; 3.0; 3.09; 4.0	0.3	0.0
Heron NSHR	Head of Canyon	1.9; 3.0; 2.09; 3.0	0.3	0.1
Pelican NSHR	Head of Canyon	2.9; 3.0; 3.09; 4.0	1.3; 1.2; 1.4	0.0
Pelican SHLF	Head of Canyon	2.9; 3.0; 3.09; 4.0	0.1; 0.5	0.1
Pelican HCNYN	Head of Canyon	2.9; 3.0; 3.09; 4.0	0.4	0.2

Methods and Tools for Achieving Sustainability

Integrated Solutions for Decision Making

Using GIS, MCDA tools together

The screenshot displays a GIS application window titled "D2M2J-GIS - Project" and a Multi-Criteria Decision Analysis (MCDA) application window titled "D2M2 - D55: cocheco_case_ex (MAUT)".

The GIS window shows a map with a network of red lines and blue lines. A scale bar indicates 2 km. The Layer Manager on the right lists layers: **r_road**, **river**, and **sites**.

The MAUT window shows a Value tree diagram with a central "Task" node connected to four criteria: **cost**, **env**, **eco.hab**, and **hum.hab**. These criteria are further linked to four alternatives: **WR**, **CM**, **UPC**, and **FF**.

The Properties window on the right shows the following details for the "env" criterion:

- Criterion properties: Name: env, Description: Environmental Quality, Weight: 0.300
- Scale properties: Units: points, Local/Global: (Global), Min value: 1.000, Max value: 3.000, Min/Max: Maximize
- Alternatives performances and scores: WR: 3.000, CM: 3.000, UPC: 2.000, FF: 2.000

The Performance table at the bottom provides a detailed view of the criteria and alternatives:

Name	cost	env	eco.hab	hum.hab
Weight	0.100	0.300	0.400	0.200
WR	Normal(aver:75.000 std.d...	Uniform(L:2.000 R:4.000)	Uniform(L:8.000 R:12.000)	Delta(aver:0.000)
CM	Normal(aver:30.000 std.d...	Uniform(L:2.500 R:3.500)	Delta(aver:0.000)	Delta(aver:0.000)
UPC	Normal(aver:40.000 std.d...	Delta(aver:2.000)	Delta(aver:0.000)	Uniform(L:2.000 R:6.000)
FF	Normal(aver:55.000 std.d...	Uniform(L:1.000 R:3.000)	Delta(aver:0.000)	Delta(aver:0.000)