Creating Outstanding Problem Solvers

Module 10: Summary and wrap up

To show how the plan came together and how much you were taught

Rev 3.2.5

Congratulations

- You have now been taught the tools and techniques you need to successfully tackle all sorts of problems
- This module contains a summary to remind you
- Now you just need to use them to fully learn them
- Practice, practice and practice
- Move on to the next course to use those tools in project management or systems engineering
- I look forward to seeing you there

Objectives

1. To summarise and close out the course
2. To show how the plan came together
3. To remind you how much you were taught

Knowledge

- Lecture
  - Summarizes course to remind you what was taught
  - What you learned was up to you
- Reading
  - 1002 Course evaluation form
  - 1003 Holistic Thinking Chapter 12 Creating Your Own Innovative Solutions
- Exercise
  - 10-11 Knowledge reading for 1003
  - 10-12 Complete course evaluation form

Topics

- **Course design**
- Summary of the sessions
- Closure

Course learning outcomes

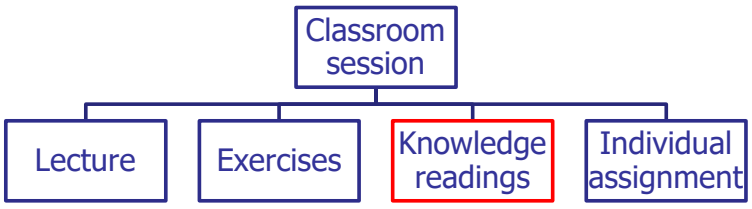
1. The ability to deal with open ended problems with no unique solutions
2. The ability to deal with ill-structured and wicked problems
3. The ability to deal with complex problems
4. Improved problem solving, systems and critical thinking abilities
5. The ability to go beyond systems thinking in the analysis of a problem and determination of a solution

Course assumptions

- Lectures summarize and point out important points
- Readings provide in-depth knowledge
- Practical activities bring knowledge to life and provide experiential anchor points
- Discussions
  - Provide feedback and reinforce book-learning
  - Provide experiential examples of knowledge
    - Instructor and participant domains
- Participants
  - Expected to do homework
    - Exercises and readings

Partnership

Balanced classroom



	Bloom's taxonomy	Lecture	Exercises	Knowledge readings
6	Creating			√
5	Evaluating			√
4	Analyzing			√
3	Applying		√	
2	Understanding	Unknown	√	√
1	Remembering	Listened	√	√

Knowledge reading exercises (R0002)

- Provide a better learning experience
  - learning for the purposes of presentation is a good way of retention of the knowledge
- Demonstrate that different people perceive information differently
- Enable the instructor to correct any misinterpretations as they arise
- Provide you with the opportunity to
  - practice presentations skills
  - obtain feedback of content and style
- Provide you with a template for thinking about reading reports/papers in future

Updated Bloom's taxonomy

Dealing with the exercises and other problems

- Determine what needs to be done (requirements)
- Formulate the problem using the Problem Formulation Template
  - Systems thinker's toolbox Section 14.3
- Work BACK from the answer!!!!!!!!!
  - Systems thinker's toolbox Section 11.8
- Create a compliance matrix
  - Systems thinker's toolbox Section 9.5.2
- Modify the presentation template
  - Systems thinker's toolbox Section 14.6
- Plan the use of allotted time
  - Figure out how much time to allocate to each part of the exercise
- Think about observations and insights from readings and prior knowledge
- Produce the required presentation
- Incorporate material to show you have looked at the readings or equivalent material
  - Citations in (author, date) format

Topics

- Course design
- **Summary of the sessions**
- Closure

The Modules

0. Overview and administration
1. Thinking and systems thinking
2. Critical thinking
3. Holistic thinking (systems thinking and beyond)
4. Problem-solving
5. Decisions and decision making
6. Remedying simple and complex problems
7. Tools and applications in project management
8. Tools and applications in systems engineering
9. Tools and applications in risk management
10. **Summary, review and closeout**

Module 1: Thinking and systems thinking

1. Three sessions
2. Learnt about and used a number of systems thinking tools
3. Learnt about and used causal loops
4. Learnt that systems thinking is generally applied but in an incomplete ad-hoc manner
5. Recognized the need to go beyond systems thinking

Knowledge component-1

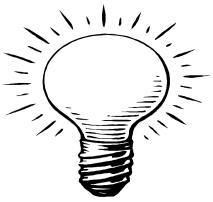
- Lecture
  - Overview and summary of readings
- Readings
  - 0102 Holistic Thinking Chapter 1: Section 1.1.
  - 0103 Kasser J.E., A theoretical multi-tasking executive function for the information processing model of the human brain, Proceedings of the 3rd International Conference on Applied Human Factors and Ergonomics (AHFE), Miami, FL, 2010
- References
  - Systems Thinker's Toolbox for individual tools discussed
  - 0150 Basics of Causal Loop Diagrams - University of Saskatchewan (66 PowerPoint slides), https://www.cs.usask.ca/faculty/ndo885/Classes/CMPT858Spring2011/LectureSlides/Lecture%206%20--%20Causal%20Loop%20Diagrams.pdf?fbclid=IwAR3R1es-NVtUI87s9LScREq1bQDXa9sw55rLDGMtfqaGiks16YslFRnCC8Y, last accessed 9/5/2024
- Exercises

Knowledge component-2

- Lecture
  - Overview and summary of readings
- Readings
  - 0104 A systemic and systematic approach to finding out-of-the-box solutions https://youtu.be/52awMkJkNgg
  - 0105 Holistic Thinking Section 4.3: The Holistic Thinking Perspectives updated in Systems Thinker's Toolbox Chapter 10
  - 0106 Kasser, J.E., Lerner B., Two major misconceptions of systems thinking exposed, British Computer Club Webinar, April 2023 (https://youtu.be/fxZa-qpnAnU)
- References
  - Systems Thinker's Toolbox for individual tools discussed
- Exercises

Module 1: Topics

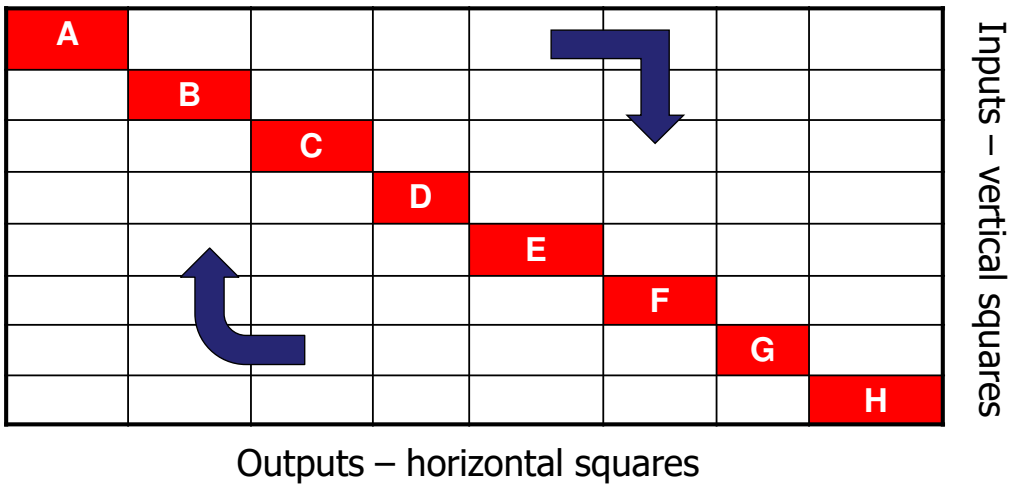
- Thinking
- Systems thinking (introduction)
- Tools to assist thinking
- Systems thinking and beyond
  - Why true understanding requires perceptions from different perspectives
  - The myth of open and closed systems
  - The distribution of Holistic Thinking Perspectives (HTP)
- Exercises



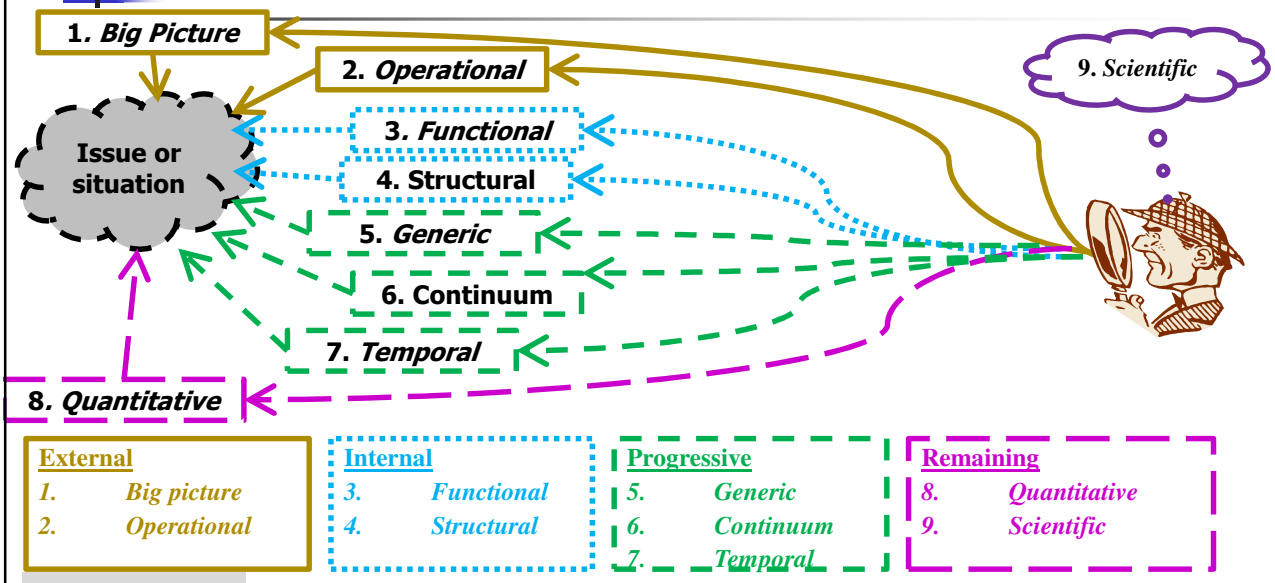
Module 1: Thinking tools

- Lists
- Drawing tools
  - Concept maps
  - Causal loops
- Cartoons
  - Make specific points
- Keep it Simple, Student (KISS)
- Flowcharts
- Tables
- N^2 charts
  - Gantt charts
  - Waterfall charts
- HTPs (introduction)

Module 1: N^2 chart representation



Module 1: The Holistic Thinking Perspectives*



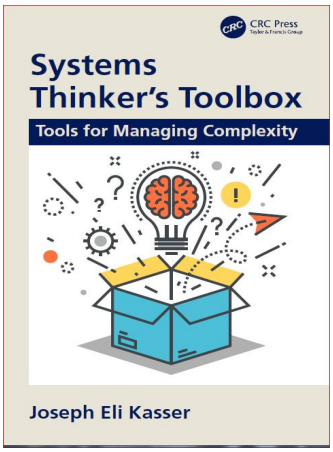
External	Internal	Progressive	Remaining
1. Big picture	3. Functional	5. Generic	8. Quantitative
2. Operational	4. Structural	6. Continuum	9. Scientific
		7. Temporal	

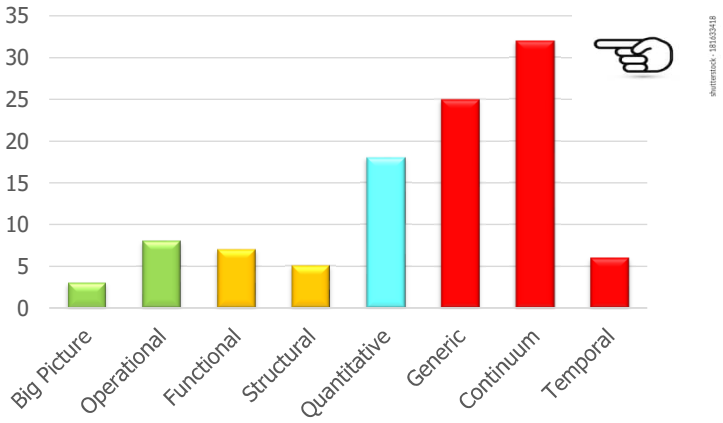
*STT 10.1

Module 1: Current situation

- Some of us use these
  - All of the time
  - Most of the time
  - Some of the time
  - None of the time
- When not thinking emotionally

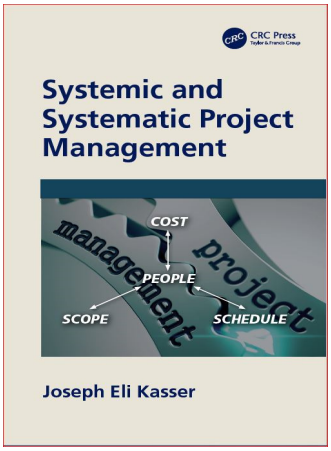
Module 1: Distribution of HTPs - Toolbox

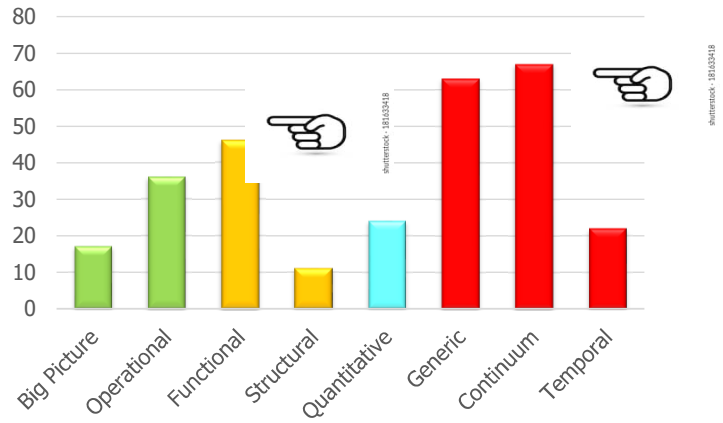




September 2018

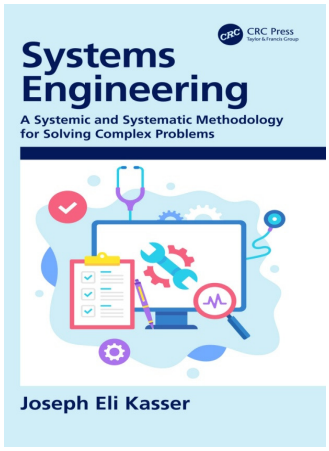
Module 1: Distribution of HTPs – Project management



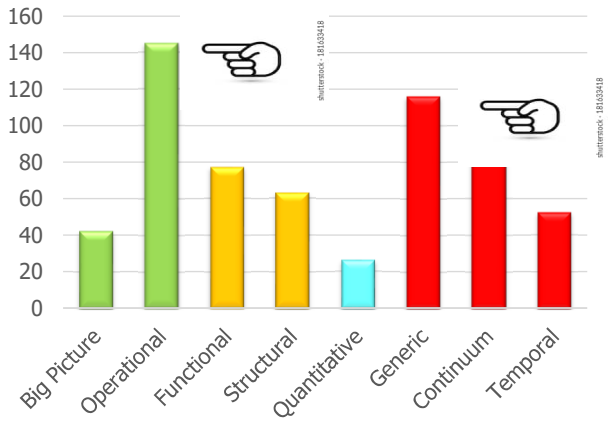


August 2019

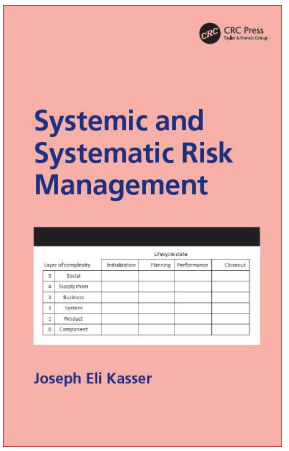
Module 1: Distribution of HTPs – Systems engineering



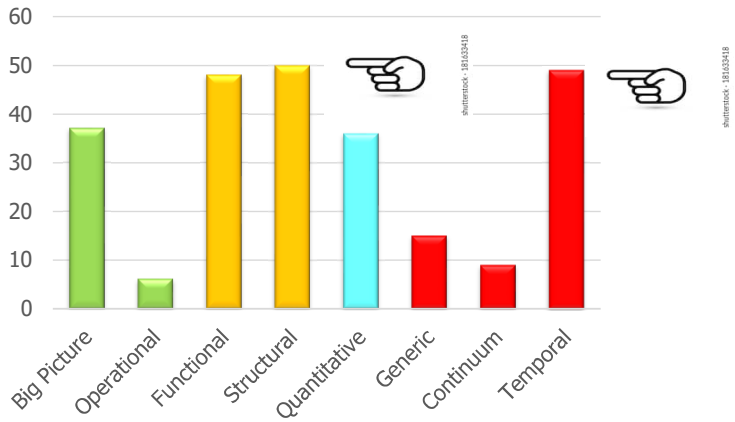
October 2019



Module 1: Distribution of HTPs - Risk management



July 2020



Module 2: Critical thinking

1. One session
2. Explained logic and reasoning
3. Explained and practiced critical thinking
4. Topics
   - Definitions
   - Critical thinking

Module 2: Knowledge component

- Lecture
  - Definitions
  - Critical thinking
- Readings
  - 0202 Holistic Thinking Chapter 5: Critical thinking.
  - 0203 FUSE Chapter 10: Systems engineers are from Mars, software engineers are from Venus.
- Exercises

Module 2: Thinking tools

- Logic
- Paradigm shift asking the right questions
- The continuum of answers
- Template for critical analysis of arguments

Module 2: The *Continuum* of answers

- Non-systems thinking
  1. Yes
  2. No
  - Deterministic
- Systems thinking
  1. Yes
  2. No
  3. It depends
  4. Don't know (unknown) or don't care
     - Dissolves Schrödinger's cat paradox

Module 2: Template for critical analysis of arguments-1*

1. What's the point (claim/opinion/conclusion)?
2. What are the reasons/what is the evidence?
   - Articulate all unstated premises and connections.
3. What exactly is meant by …?
   - Define terms
   - Clarify all imprecise language
   - Eliminate or replace "loaded" language and other manipulations
4. Assess the reasoning/evidence
   - If deductive, check for truth/acceptability and validity
   - If inductive, check for truth/acceptability, relevance and sufficiency

* Tittle P, 2011:17

Module 2: Template for critical analysis of arguments-2*

5. How could the argument be strengthened?
   - Provide additional reasons/evidence
   - Anticipate objections – are there adequate responses
6. How could the argument be weakened?
   - Consider and assess counterexamples, counterevidence and counterarguments
   - Should the argument be modified or rejected because of the counterarguments?
7. If you suspend judgment (rather than accepting or rejecting the argument), identify further information required in order to make a judgment

* Tittle P, 2011:17

Module 2: Plastic bag tree?

- Conclusions, decisions and inferences are only as good as your domain knowledge

Module 3: Holistic thinking: going beyond systems thinking

1. Three sessions
2. Explained the nature of systems
3. Showed how holistic thinking can result in innovative solutions to problems
4. Practiced holistic thinking

Module 3: Knowledge component

- Lecture
  - Systems
  - Nature of systems
  - System behaviour
- Readings/video
  - 0302 Holistic Thinking Chapter 6: Holistic Thinking
  - 0303 Holistic Thinking Chapter 11: Innovative insights and solutions
  - 0304 Why you should be using systems thinking to solve problems, https://www.youtube.com/watch?v=wXj-lCYSmGk
- Exercises

Module 3: Thinking tools

- Principle of Hierarchies
- HTPs
- Active Brainstorming
- Idea Storage Templates (IST)
  - SWOT
  - OARP
  - FRAT
  - SPARK

Module 3: Active Brainstorming: HTP Matrix for triggering ideas

HTP	Who?	What?	Where?	When?	Why?	How?
Operational						
Functional						
Big picture						
Structural						
Generic						
Continuum						
Temporal						
Quantitative						
Scientific						

There may not be an immediate answer to every question
Input tool, not a storage tool

New

Constraint mapping (Dunn, 2012) Matrix for triggering ideas

Constraint	Who?	What?	Where?	When?	Why?	How?
Physical						
Legal						
Organizational						
Political						
Distributional						
Budgetary						
Other						

Another set of perspectives : schedule, etc. use as appropriate

There may not be an immediate answer to every question
Input tool, not a storage tool

Module 4: Problem solving

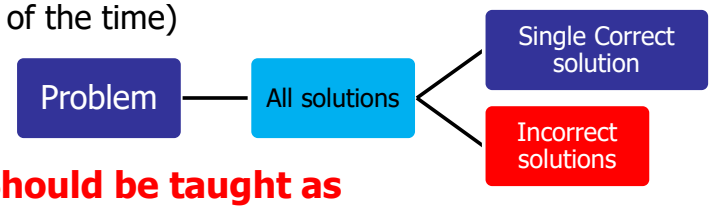
1. Two sessions
2. Explained the need to, and difficulty of, identifying the correct problem
3. Explained the consequences of not identifying the correct problem
4. Explained the need for short term and long term solutions and why they might be different
5. Distinguished between different types and classifications of problems
6. Reviewed and elaborated on the problem solving process

Module 4: Knowledge component

- Lecture
  - Problems and problem-solving
  - The problem-solving process
  - Properties of a good problem statement
  - Classification of problems
  - The domains of the problem
  - The Problem Formulation Template (PFT) and why you should start using it today
- Readings/videos
  - 0402 HT Chapter 9: Problems and solutions
- Exercises

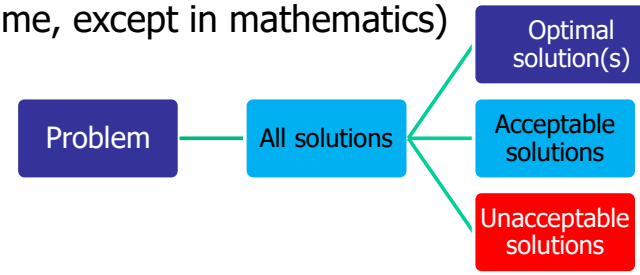
Module 4: Problems and solutions

Currently taught as
(most of the time)



Should be taught as
(all of the time, except in mathematics)

Who defines the problem?

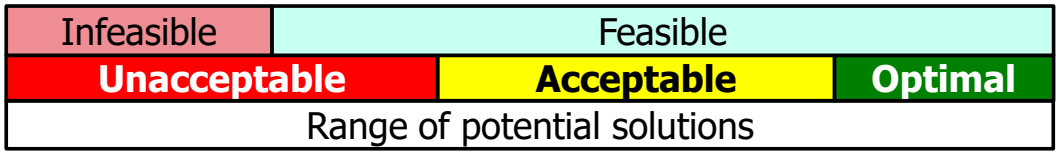


Satisfy

Satisfice

Module 4: The *Continuum* of solutions

- Non-systems thinking
  - Single correct
  - Remainder are wrong (incorrect)
- Systems thinking
  - Feasible
  - Infeasible
  - Unacceptable
  - Acceptable
  - Optimal



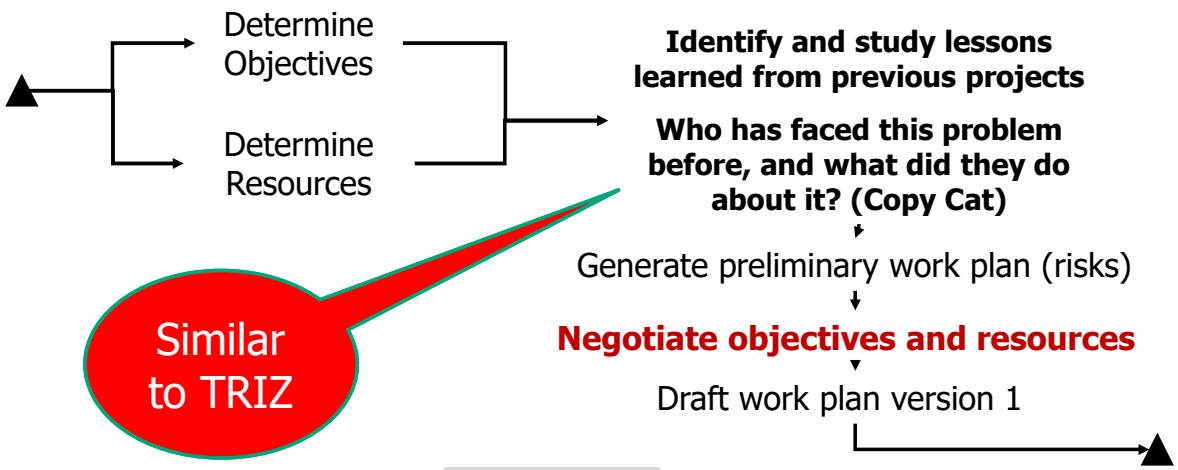
Module 4: The *Continuum* of answers

- Non-systems thinking
  1. Yes
  2. No
  - Deterministic
- Systems thinking
  1. Yes
  2. No
  3. It depends
  4. Don't know (unknown) or don't care
     - Dissolves Schrödinger's cat paradox

No	Don't know	Yes
0% ..... Non-deterministic probability.....		100%

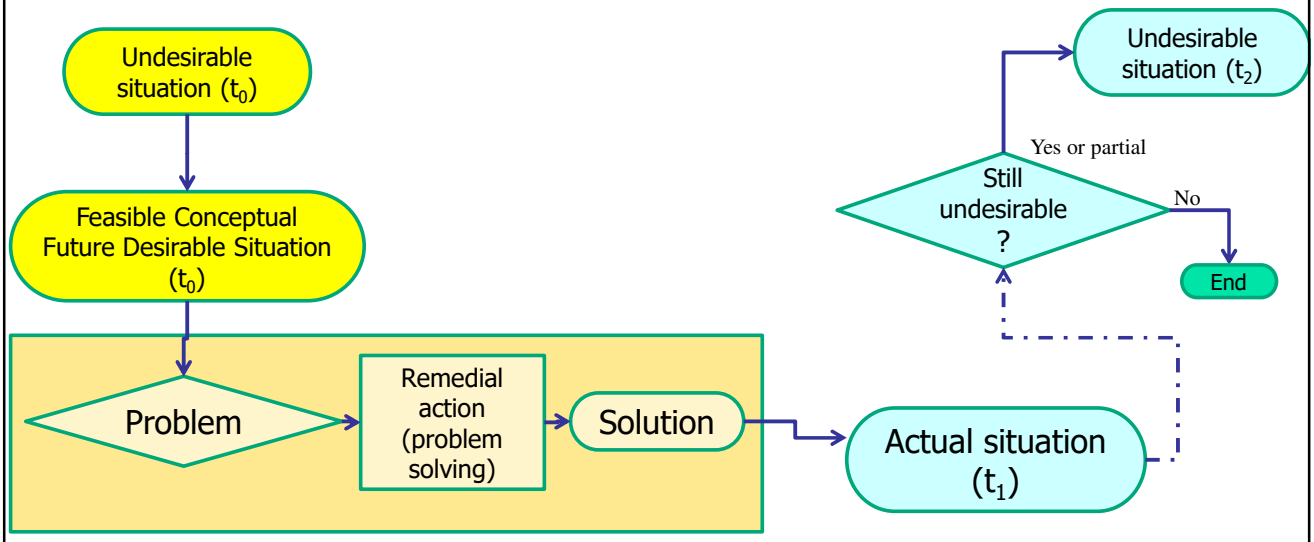
Strongly disagree	Disagree	Don't care	Agree	Strongly agree

Module 4: Process for tackling a problem*



* Kasser 2007

Module 4: Problem-solving loop (*Temporal*)



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Module 4: Classification of problems

1. Level of difficulty of the problem
2. Research and intervention problems
3. Structure of the problem
4. Complexity of the problem
   - Not discussed in this session
5. Others

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Levels of difficulty* (subjective complexity)

1. ***Easy***
   - Can be solved in a short time with very little thought
2. ***Medium***
   - Can be solved after some thought
   - May take a few more steps to solve than an easy problem
   - Can probably be solved without too much difficulty, perhaps after some practice
3. ***Ugly***
   - Will take a while to solve
   - Involves a lot of thought and many steps
   - May require the use of several different concepts
4. ***Hard***
   - Usually involve dealing with one or more unknowns
   - Involves a lot of thought and some research
   - May also **require iteration through the problem-solving process** as learning takes place

* Based on Ford, W., Learning and teaching math, 2010, http://mathmaine.wordpress.com/2010/01/09/problems-fall-into-four-categories/, accessed on 29 March 2024

More levels of difficulty*

5. **Unsolvable**
   - Cannot be solved based on the knowledge 'we know we know' today with available resources
6. **Impossible**
   - Can never be solved based on the knowledge 'we know we know' today (we think)

- Not much use in engineering, but research is continuously moving problems in these levels down into lower levels by increasing the knowledge 'we know we know'

* Proposed by Bruce Lerner in online Oasis Café meeting on 29 March 2024, adjusted 12 April with help from Ricardo Reis and Pascal Boholu Mabelo

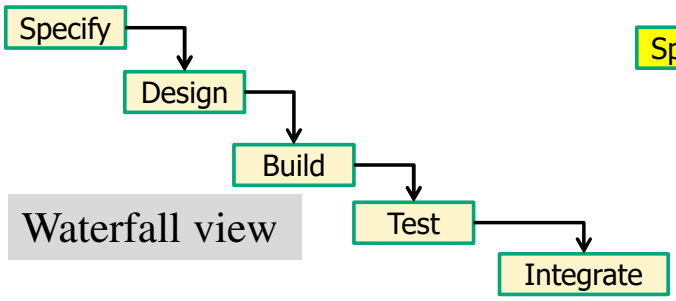
Module 4: Forward-backward-forward

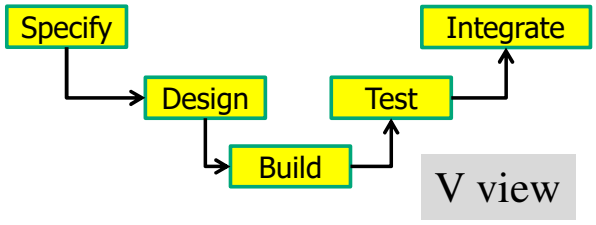
Conceptualize a vision of the FCFDS

Work backwards, conceptualizing the process to get there

Specify → Design → Build → Test → Integrate

Document the process as a forward looking plan





Module 4: Problem Formulation Template

1. ***The undesirable situation***
   - As perceived from the HTPs (objects and relationships)
2. ***Assumptions***
   - About the situation, problem, solution, constraints etc.
3. ***The Feasible Conceptual*** *Future Desirable* ***Situation (FCFDS)***
   - As perceived from the HTPs
4. ***The problem***
   - **What** needs to be done to convert the FCFDS to reality in reverse order
5. ***The solution*** (may be TBD at start of problem-solving process)
   - **How** the undesirable situation will be/was remedied
   - Has to be interoperable with evolving adjacent systems over the operational life of solution and adjacent systems
   - Is made of two interdependent parts
     1. The transition process (flow chart)
     2. The solution system operating in the context of the desirable situation

Module 4: Initial reactions to problems

- **P –** perplexing – I don't understand it
- **A –** ask someone else
- **N –** no time to deal with it
- **I –** I can't deal with it
- **C –** it is too complicated

Module 4: Initial reaction – Stall*

- **S**tay calm
- **T**hink
- **A**sk questions and analyse
- **L**isten (and look)
- **L**isten (and look)

* Kasser 2008, Page 10-17

Module 5: Decisions and decision making

1. Two sessions
2. Discussed the nature of, and made different types of decisions
3. Discussed and used different decision-making tools
4. Discussed evaluating decision making tools and determining the one most suitable for a specific decision
5. Made decisions
6. Discussed the nature of objective and subjective decision making

Module 5: Knowledge

- Lecture
  - Overview and summary of readings
- Reading/video
  - 0502 Holistic Thinking Chapter 8: Decisions and decision making
  - 0503 Kasser, J.E., Why selecting the wrong course on systems thinking, systems engineering or project management could cost you $1,000s more than the fee, July 2021, https://youtu.be/DTTrobYjLqg
- Exercises

Module 5: Topics

- Uncertainties and risks
- Decision traps
- Subjective trade-off methods
- Quantitative and qualitative decisions
- Decision tree analysis
- Indirect techniques
- Selection criteria
- Tabular methods and Multi-attribute Variable Analysis
- Value functions and utility curves
- Decision outcomes
- Exercises

Module 5: Decision table for known outcomes of actions*

	Certain	Uncertain	Certain
Probability of occurrence	0% (will never happen)	< 100% (might happen)	100% (will always happen)
Desired	Need to conceptualize an alternative action	Opportunity that should be planned for, depending on probability of occurrence	Preferred outcome
Don't care	Ignore	Opportunity that might be considered depending on probability of occurrence	Opportunity that could be taken advantage of
Undesired	Can be ignored	Risk that should be mitigated depending on probability of occurrence and severity of consequences	Outcome that must be prevented or mitigated depending on severity of consequences

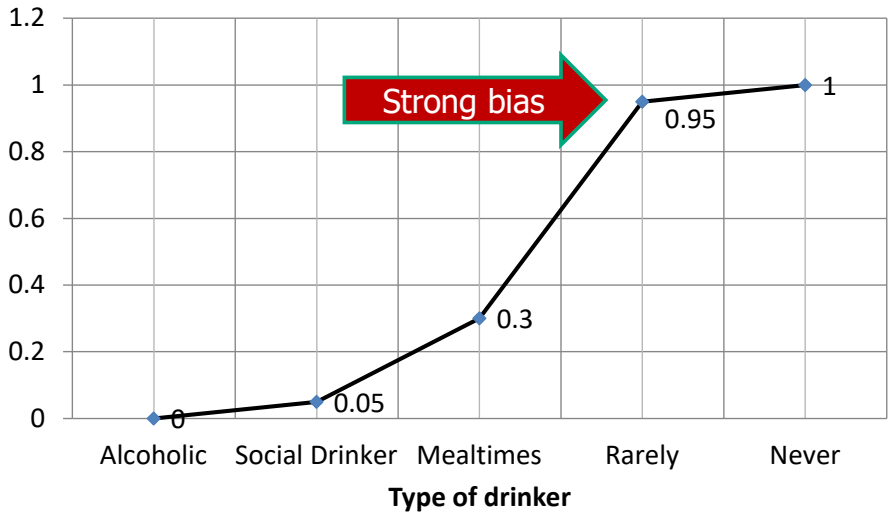
* HT Table 8.1

Module 5: Decision traps*

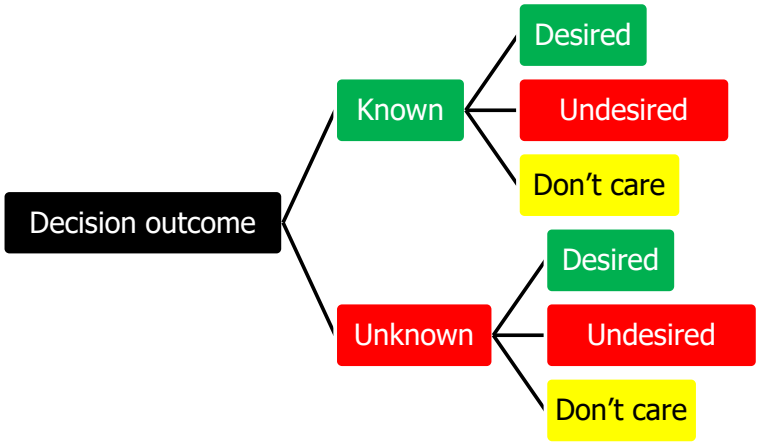
1. Plunging in – not defining the right problem
2. Frame blindness – defining the wrong problem
3. Lack of frame control – viewing from the wrong perspective
4. Overconfidence in your judgment – failing to collect facts because you are sure of your opinions
5. Shortsighted shortcuts
6. Shooting from the hip
7. Group failure
8. Fooling yourself about feedback

* 8 of 10 in Russo, J. E. and Schoemaker, P. H., *Decision Traps*, Simon and Schuster, New York, 1989.

Module 5: Fred's Alcohol drinking custom utility function



Module 5: Decision outcomes *Continuum* HTP



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Module 6: Remedying simple and complex problems

1. Two sessions
2. Explained complexity using the HTPs
3. Explained the difference between simple and complex problems
4. Explained how to remedy complex problems
5. Explained how to remedy wicked problems

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Module 6: Knowledge

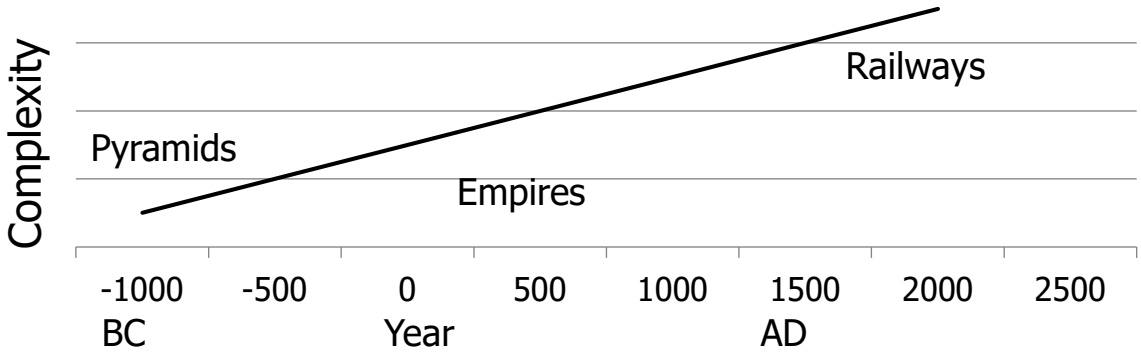
- Lecture
  - Overview and summary of readings
- Readings/videos
  - 0602 POSE Chapter 16: The nine-system model
  - 0603 Holistic Thinking Chapter 12: Creating your own innovative solutions to complex problems
  - 0604 How many objects does a system have to contain to be a complex system?, 2020, https://youtu.be/w7IKXnQE5nY
  - 0605 POSE Chapter 18: Guidelines for creating a system
- Exercises

Module 6: Topics

- Complexity
- Managing complexity (complex problems) by
  - Using an actual number for "large" in the definition of objective complexity?
  - Separating objective and subjective complexity help remedy complex problems
- Reasons why some people can tackle complexity successfully while others cannot
- The nine-system model
- Exercises
- Summary

Module 6: Complexity : *Temporal*

- Tackling problems posed by complexity has always been at the boundary of knowledge



Module 6: Complexity : *Scientific*

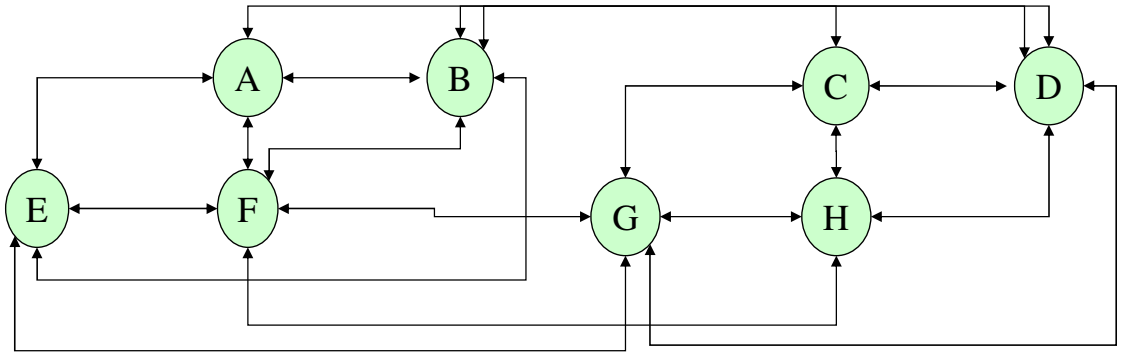
- Answers to:
  1. What is the value of "large" in the definition of objective complexity?
  2. Can separating objective and subjective complexity help remedy complex problems?
  3. Why can some people tackle complexity successfully while others cannot?

Module 6: Thinking about the value of "large"

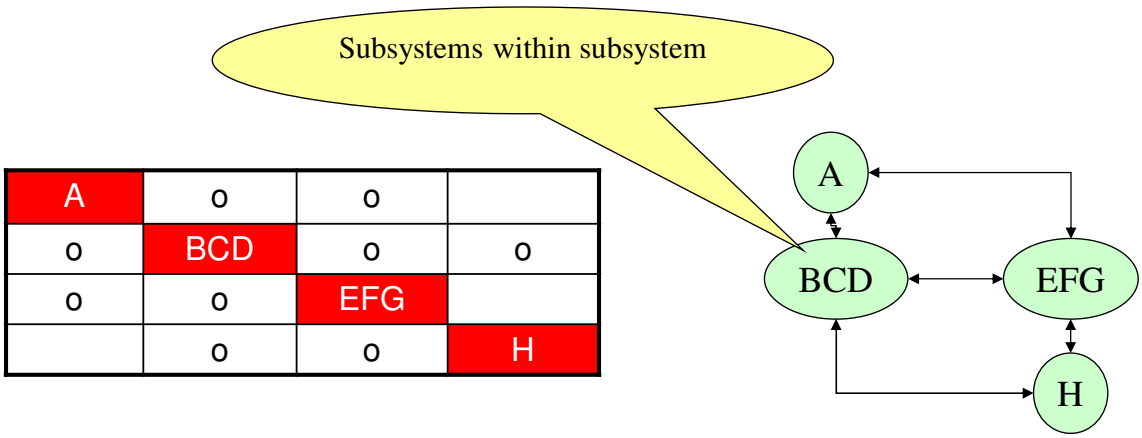
- *Operational*
  - Complexity is in the eye of the beholder
    - Jackson, M. C. and Keys, P (1984)
- *Functional*
  1. Complexity is actually sensed by the eye of the beholder
  2. Beholder thinks about the complexity
  3. Complexity is in the mind of the beholder
- *Quantitative*
  - Limitation on number of elements in mind is 5-10
    - 7 ± 2 (Miller's rule), 10 (Military rule), also used when building the ancient Egyptian pyramids
- *Scientific* conclusion
  - Minimum value of 'large' is 5-10 (applying Military and Miller's rules)

Module 6: Example: from Module 1

- **Problem:** simplify complex system by aggregating simple low level functions (A-H) into more complex higher level functions



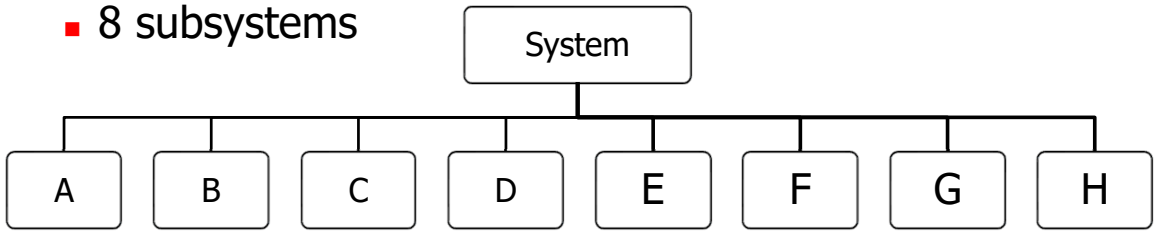
Module 6: Aggregated (synthesized) subsystems



A	o	o	
o	BCD	o	o
o	o	EFG	
	o	o	H

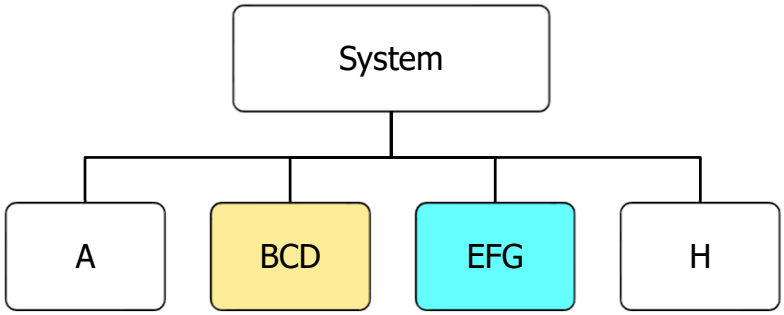
Module 6: *Structural* HTP (before)

- System
  - 8 subsystems



Module 6: *Structural* HTP (after)

- System
  - 4 subsystems
    1. A
    2. BCD
    3. EFG
    4. H
- **BCD**
  - **3 subsystems**
- **EFG**
  - 3 subsystems

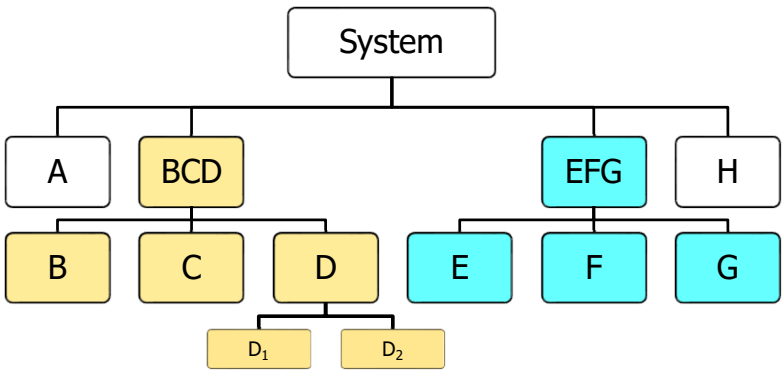


Systems of interest = working level ±1

Creating Outstanding Problem Solvers 10-67

Module 6: *Structural* HTP (after)

- System
  - 4 subsystems
    1. A
    2. BCD
    3. EFG
    4. H
- BCD
  - 3 subsystems
- EFG
  - 3 subsystems



Systems of interest = working level ±1

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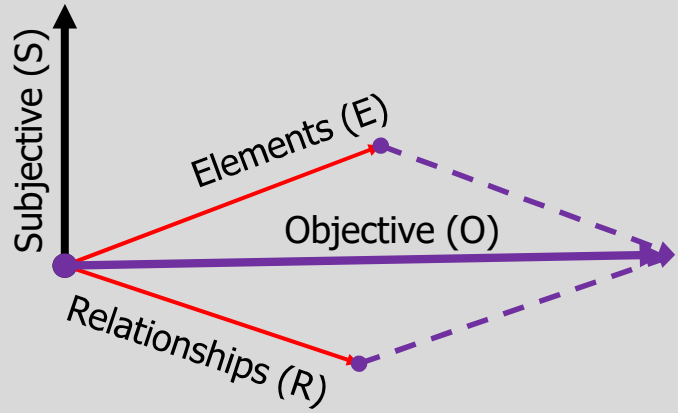
Module 6: Something to argue about Complexity - Structure

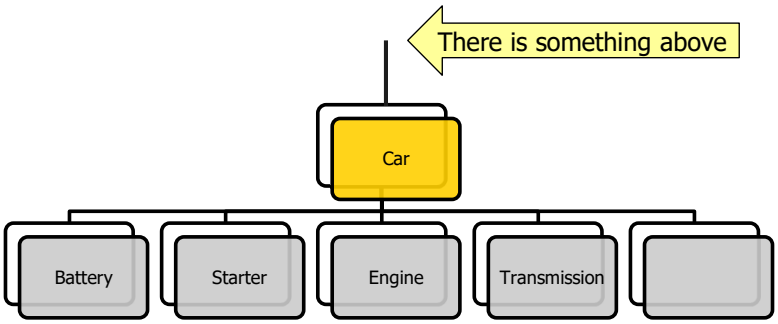
- Subjective (domain knowledge)
  1. Easy
  2. Medium
  3. Hard
  4. Ugly
- Objective
  - Number of elements
  - Relationships
    - Static
    - Dynamic
    - Temporal
    - Combination
    - Other



~~Complexity = aS$_{(1-4)}$ X ~~ ~~k~~ ~~√(O$_{(bE^2 + cR^2)}$)^d ?~~

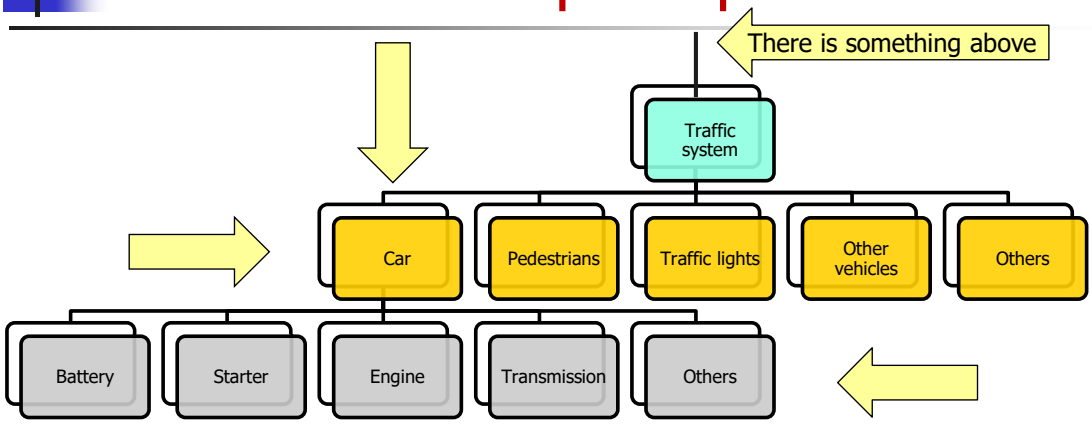
~~a, b, c, d and k represent parameters, ? Shows untested hypothesis~~

Module 6: The principle of hierarchies



Systems thinking, analysis = understanding relationships
Internal problem

Module 6: The principle of hierarchies



Systems thinking, analysis = understanding relationships
External problem
System of interest depends on the problem (Reading 0106)

Module 6: Confusing complexity with 'ill –structured problems"

Objective Complexity

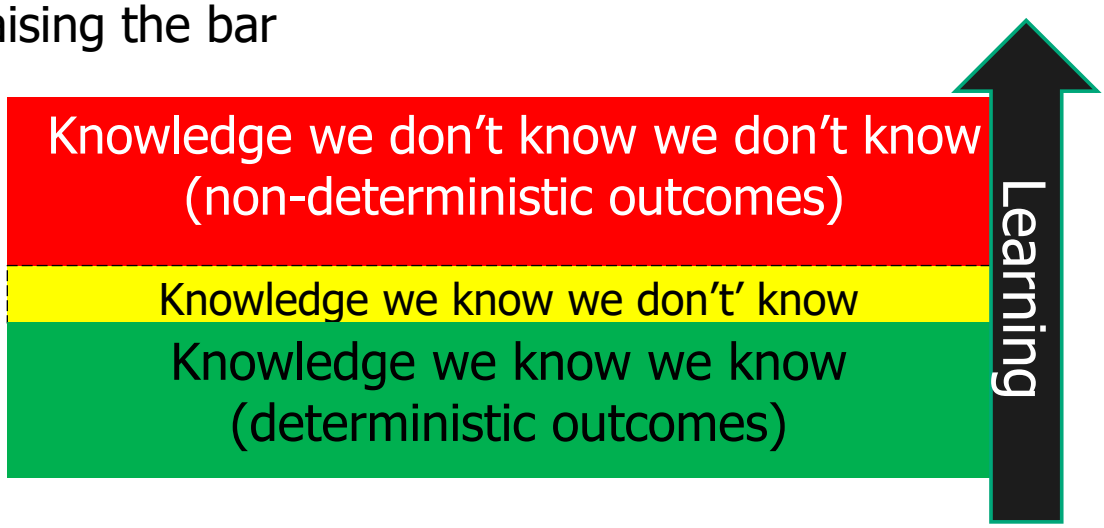
- Real world
- *"A complex system usually consists of a large number of members, elements or agents, which interact with one another and with the environment"*, ElMaraghy et al., 2012
- Artificial (Kasser and Palmer, 2005)

Ill-structured problems

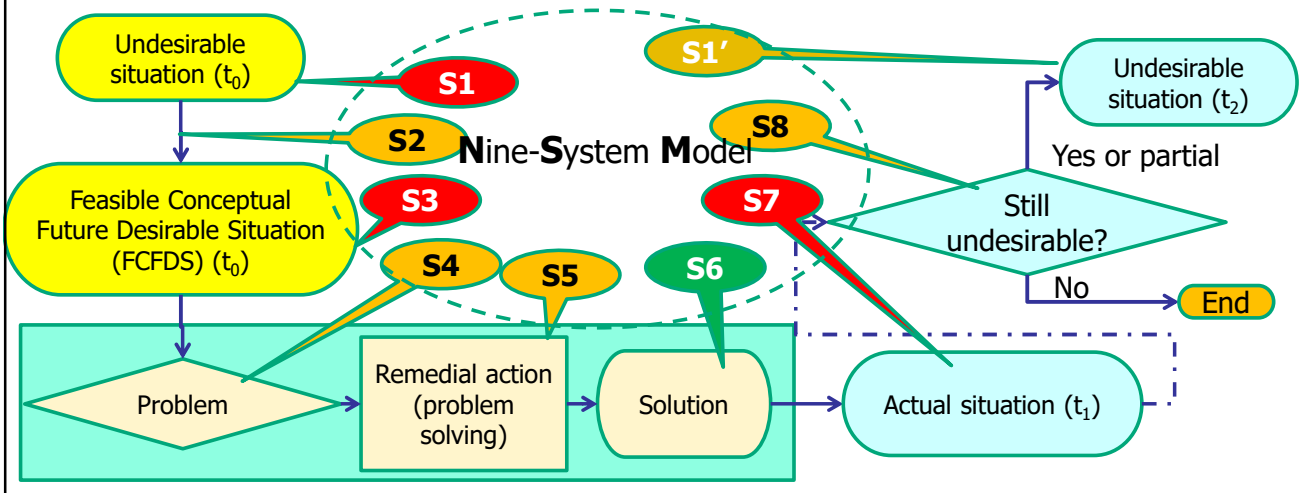
- Sometimes called 'ill-defined' problems or 'messy' problems are problems where either or both the existing undesirable situation and the FCFDS are unclear (Jonassen, 1997)
  - The initial feeling that something is wrong and needs to be changed
  - Where the FCFDS is unclear.
  - Where different stakeholders perceive different causes of the situation and different ways of dealing with the causes.

Module 6: Moving the boundary of knowledge

- Raising the bar

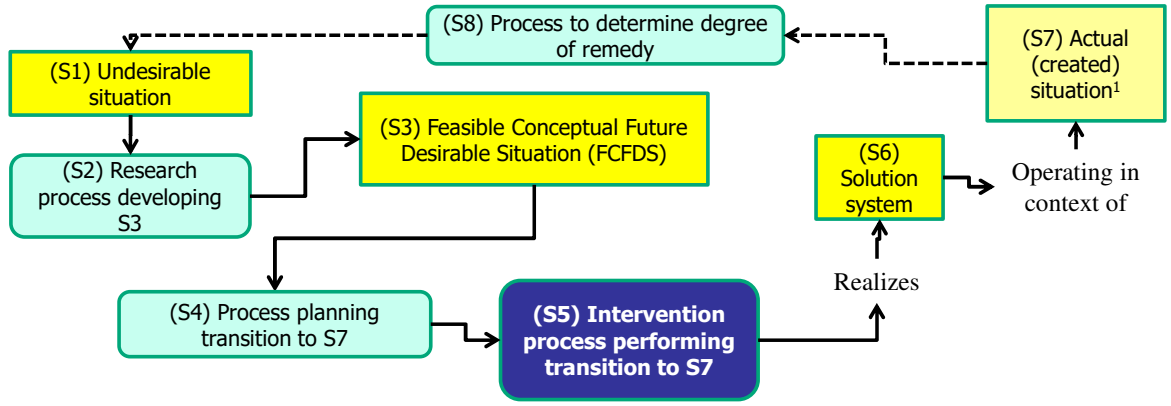


Module 6: Holistic systems approach to managing problems and solutions



Module 6: The Nine-System model

Functional HTP



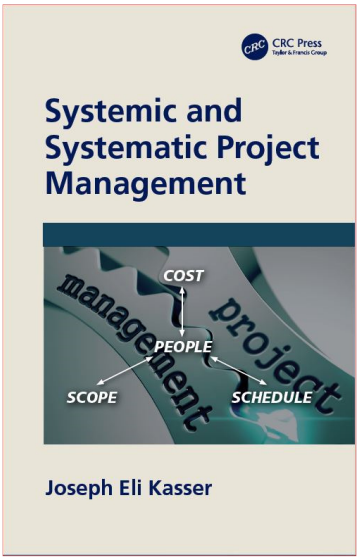
1. The solution systems and the adjacent systems are subsystems in the actual situation

Module 7: Tools and applications in project management

1. One session
2. Discussed the systems approach to planning
3. Showed how Systems Thinking And Beyond (STAB) tools can improve project management
   - Increasing probability of a successful project
4. Explained a few STAB tools for project management

Module 7: Knowledge

- Lecture
  - Overview and summary of tools
- Readings/Videos
  - 0790 The Systems Approach to Planning, 2015, https://www.youtube.com/watch?v=JNT4Rc7R8xg
  - 0791 Improving project status reporting with Enhanced Traffic Light (ETL) Charts, 2016, (STT Section 8.16.2) https://www.youtube.com/watch?v=fwM_9otO0F0
  - 0792 Improving monitoring of technical performance by using Categorized Requirements in Process (CRIP) charts, 2015, (STT Section 8.1) https://www.youtube.com/watch?v=5AUafacJ5AU
- Exercise



Module 7: The Systems Approach to Planning

- Three streams of activities (STT 8.1.4)
- Working back from the solution (STT 11.8)
- Product-based planning
- Work packages (STT 8.19)
- PAM Charts (STT 2.14)
- PAM Networks (STT 2.14.2)
- Number in threes
- Prevention – risk management

Module 7: Topics

- **The project lifecycle**
- The Systems Approach to Planning
- Systems approach to monitoring and communicating
- Enhanced Traffic Light (ETL) Charts
  - Improving project status reporting with Enhanced Traffic Light Charts
- CRIP charts
  - Improving monitoring of technical performance by using CRIP charts
- Exercises
- Summary

Module 7: Tasks in three streams of work

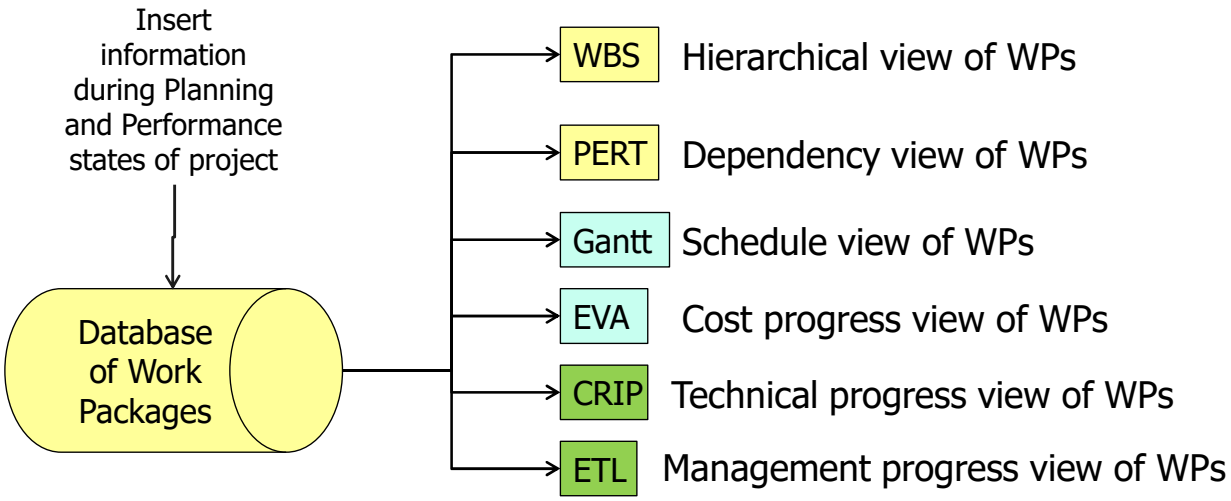
- Consists of activities in series and parallel
- Performed in three streams between milestones
- Produces product using resources taking time

Module 7: Current Enhanced Traffic Light Chart*

#	Projects	Last time	Current		Next
			Expected	Actual	
1	Project ho-hum				
2	Project oh oh	T B		T S	T S
3	Project catching up	S	S	S	
4	Project replace manager?	B S	B S	B S	B S
5	Project very happy customer		S	BS	S
6	Project completed				N/A
7	Project promote manager	P S	P S		
8	Project watch this person	B S			S
9	Project no risk management		T B S	T B S	T B S
10	Project manager took course in risk management?				T
11	Project manager doing risk management? (No effect on B and S)	T	T	T	T

* T added to explicitly identify technical problems (Suggested by Pascal Bohulu Mabelo), P remains for personnel problems

Module 7: Views of project data

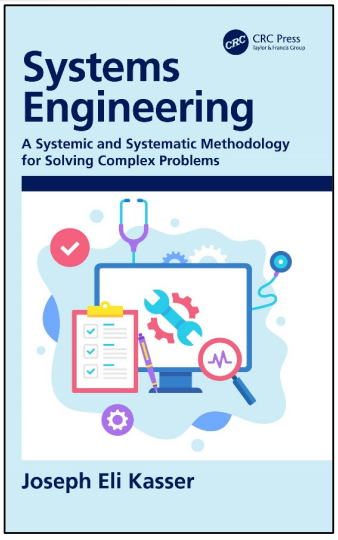


Module 8: Tools and applications in systems engineering

1. One session
2. Showed how systems thinking and beyond (STAB) tools can improve systems engineering
   - Increase probability of a realizing a system compliant to requirements
3. Explained a few STAB tools for systems engineering

Module 8: Knowledge

- Lecture
  - Overview and summary of tools
- Readings/Videos
  - 0802 Kasser, J.E., *Applying Holistic Thinking to the Problem of Determining the Future Availability of Technology*, IEEE Transactions on Systems, Man, and Cybernetics: Systems, Volume 46, Number 3, 2016.
- Exercise



Module 8: Topics

- The system lifecycle
- Attribute profiles
- KISS
- Principle of hierarchies
- Zone of ambiguity
- Exercises

Module 8: Tools

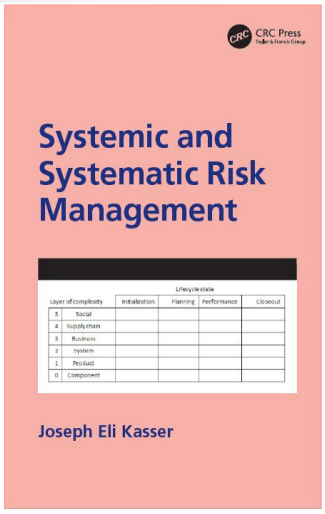
- Lecture
  - The system lifecycle
  - Attribute profiles (STT Section 9.1)
  - KISS (STT Section 3.2.3)
  - Zone of ambiguity (STT Section 13.5)
  - Principle of hierarchies (STT Section 3.2.7)
  - Exercises
- Previous sessions
  - N^2 charts (STT Section 2.10)
  - Compliance matrix (STT Section 9.5.2)
  - The Nine-System Model
- Readings
  - The TAWOO (STT Section 8.12)

Module 9: Tools and applications in risk management

1. One session
2. To show how systems thinking and beyond (STAB) tools can improve risk management
3. To explain a few STAB tools for risk management

Module 9: Knowledge

- Lecture
  - Overview and summary of tools
- Readings/Videos
  - 0902 POSE Chapter 14.2 A competency model maturity framework
  - 0903 FUSE Chapter 28 Getting the right requirements right
  - 0904 HT Chapter 10, Examples of the application of the systems engineering approach to problem, Section 10.3.1 Developing an optimal classroom teaching and learning environment.
    - How easy it is to go wrong
  - 0905 FUSE Chapter 10, Systems engineers are from Mars, software engineers are from Venus.(repeat of 0203)
    - How easy it is to miscommunicate and not realize it
- Exercise

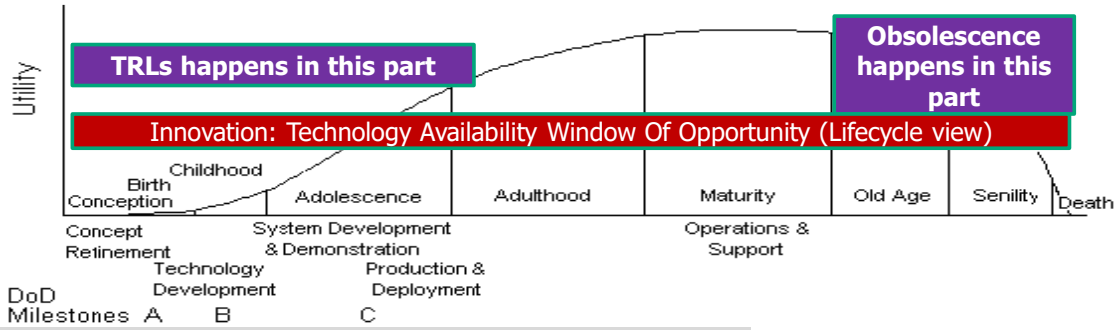


Module 9: Topics

- Definitions
- Risks based on technological uncertainty
- Risk rectangles and why not to use them
- Risk profiles
- Risks in using poor people (lecture and 0902)
- Risk and opportunity identification and mitigation
- Opportunity identification
- Survivorship bias
- The doomed classroom project (0904)
- Mitigating communications risks (0905)
- The flaw in the 'B' paradigm (0903)
- Exercise

Module 9: *Temporal* HTP: The Technology Lifecycle*

Many products use technology represented by sequential 'S' curves inside whale



* Whale diagram from "TRL Calculator", William L. Nolte, AFRL at Assessing Technology Readiness and Development Seminar, 4/28/05

Module 9: The TAWOO

TAWOO		TRL	Comments
6	Antique	12	Few if any spares available in used equipment market
5	Obsolete	11	Some spares available, maintenance is feasible
4	Approaching obsolescence	10	Use in existing products but not in new products
3	Operational	9	Available for use in new products (in general)
2	Development	8	Actual system completed and "flight qualified"
		7	System prototype demonstration
		6	System/subsystem model or prototype demonstration
1	Research	5	Component and/or breadboard validation
		4	Component and/or breadboard validation in laboratory environment
		3	Proof-of concept
		2	Technology concept and/or application formulated
		1	Basic principles observed and reported

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Module 9: Project risk framework

Layer of objective complexity		Lifecycle state			
		Initialization	Planning	Performance	Closeout
5	Social				
4	Supply chain				
3	Business				
2	System				
1	Product				
0	Component				

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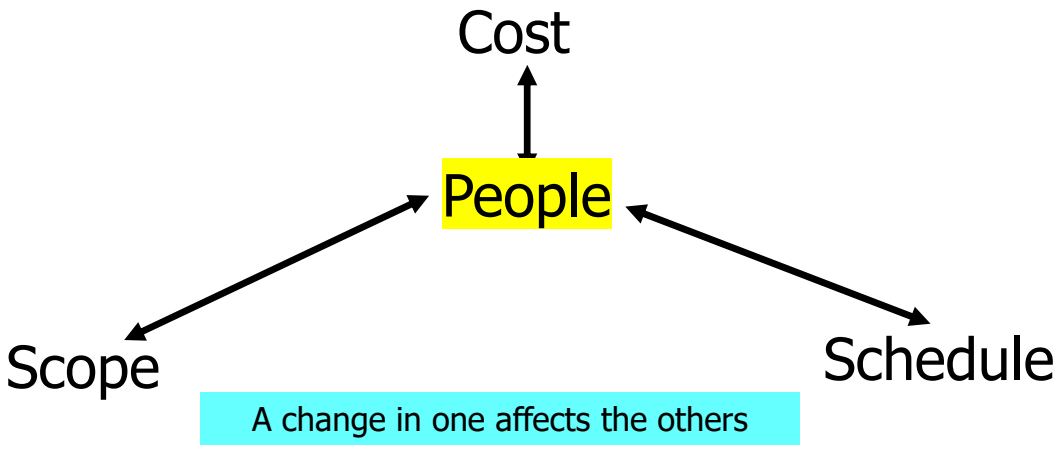
Module 9: Quadruple constraints



Module 10: Meeting the objectives

1. Summarised and wrapped up the course
2. Showed how the plan came together
3. Reminded you how much you were taught

Exercise 10-1

1. Fill out the course evaluation form (1002)
2. Save as a Microsoft Word file as Exercise10-1-abcd.doc(x)
3. Post/email presentation as and where instructed

Knowledge reading exercise 10-2

1. Prepare a brief on two main points in reading 1003 (< 5min)
2. Presentation to contain
    1. A summary of the content of the reading (<1 minute)
    2. The compliance matrix
    3. The problem formulated per the problem formulation template
    4. This slide and lesson version number
    5. A list of the two points
    6. The two briefings
    7. Reflections and comments on reading (<2 minute)
    8. Comparisons of content with other readings and external knowledge
    9. Why you think the reading was assigned to the module
    10. Lessons learned from module and source of learning e.g. readings, exercise, experience, etc. (<2 minutes)
3. Save as a PowerPoint file as Exercise10-2-abcd.pptx
4. Post/email presentation as, when and where instructed
5. Brief on one main point

Questions or comments?

- Evaluation forms (1002)
  - Email: subject COPS evaluation form
- Certificates of completion
  - Sometime after receipt of completed evaluation form
- Its time to move on to the next course to use those tools in project management or systems engineering
- I look forward to seeing you there
- Anything else?
- Best Worst Missing

Any questions ?

1. Best
2. Worst
3. Missing

Email:
beyondsystemsthinking@yahoo.com
Subject: <class title> BWM Session #