

Creating Outstanding Problem Solvers

Module 4: Session 2 of 2

Problem solving



Rev 2.11.17



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4-39

Knowledge component



- Lecture
 - Overview and summary of reading
- Readings/videos
 - 0403 A systemic and systematic approach to finding out-of-the-box solutions
(<https://youtu.be/52awMkJkNgg>)
 - No knowledge reading, it's the third part of the lecture unless you insist on doing one
- Exercises

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Topics

- ~~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
- Exercises

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4-41



Properties of a good problem statement

- Answer implementation independent
 - Does not tell you what the answer is
- Quantitative
- Unambiguous
- Concise
- Pertinent
 - Boundaries (external and internal)
- Complete
- Stated as a function
- Insensitive to errors in interpretation

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Insensitive to errors in interpretation



<http://www.youtube.com/watch?v=By0oe7BUDWQ> last accessed 27 June 2021

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Thoughts

- The unintended ambiguity in the question resulted in an unintended outcome
- Ambiguity introduces errors in interpretation

1. Why did she ask the question?

2. What question should the operator have asked?

Pause the video and think about the two questions I just posed

Post the answers in the Asynchronous group; create a topic title
'make sure he's dead'

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Lessons learned

- Asking the right question may not be easy in some situations
- *Continuum* HTP – a question be interpreted in several ways
- Importance of avoiding ambiguity
- Need to know what you want the person answering the question to do
 - Take an action
 - Make sure he's dead
 - Provide information
 - Describe why you think he's dead?
 - Analyze information and provide result
 - What makes you think he's dead?

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Components of a problem*

1. The decision maker faced with the problem
2. The control variables, the aspects of the problem situation the decision maker can control
3. The uncontrolled variables, the aspects of the problem situation the decision maker cannot control which constitute the problem environment
4. Constraints imposed from within or without on the possible values of the controlled and uncontrolled variables
5. The possible outcomes produced jointly by the decision maker's choice and the uncontrolled variables
 - There may be unknown uncontrolled variables

*Ackoff, 1978, pages 11 and 12.

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Topics



- Properties of a good problem statement
- **Classification of problems**
- **The domains of the problem**
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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 lesson
5. Others

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
- 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

Research problems

- The undesirable situation is the inability to explain observations of phenomena or the need for some particular knowledge. In this situation:
 - **the solution** is the knowledge often in the form of the supported hypothesis,
 - **the problem** is how to gain the needed knowledge, and
 - **the problem solving process** is commonly known as the scientific method, and works forwards
 - from the current situation towards a future changed situation in which the knowledge has been acquired.

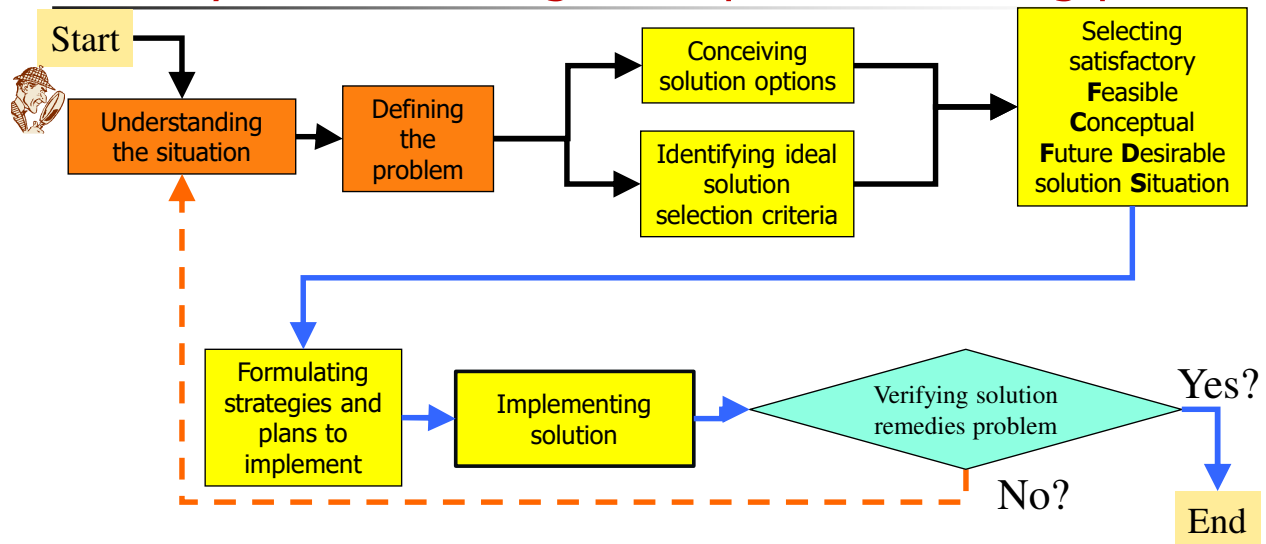
Intervention problems

- The undesirable situation is when something needs to be changed over a period of time into a FCFDS. In this situation:
 - **the solution** is the FCFDS,
 - **the problem** is how to realize a smooth and timely transition from the current situation to the FCFDS, and
 - **the problem solving process** *works backwards* to the current problematic situation to document:
 - the FCFDS, and
 - the realization plans documented as a *forward process* starting from the current situation and ending with the deployment of the FCFDS.

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Systematic: the generic problem-solving process



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Structure of the problem

1. Well-structured
 - The existing undesired situation and the FCFDS are clearly identified
 - May have a single solution or sometimes more than one acceptable solution
2. Ill-structured
 - Either or both the existing undesired situation and the FCFDS are unclear
3. Wicked
 - Extremely ill-structured problems/situations

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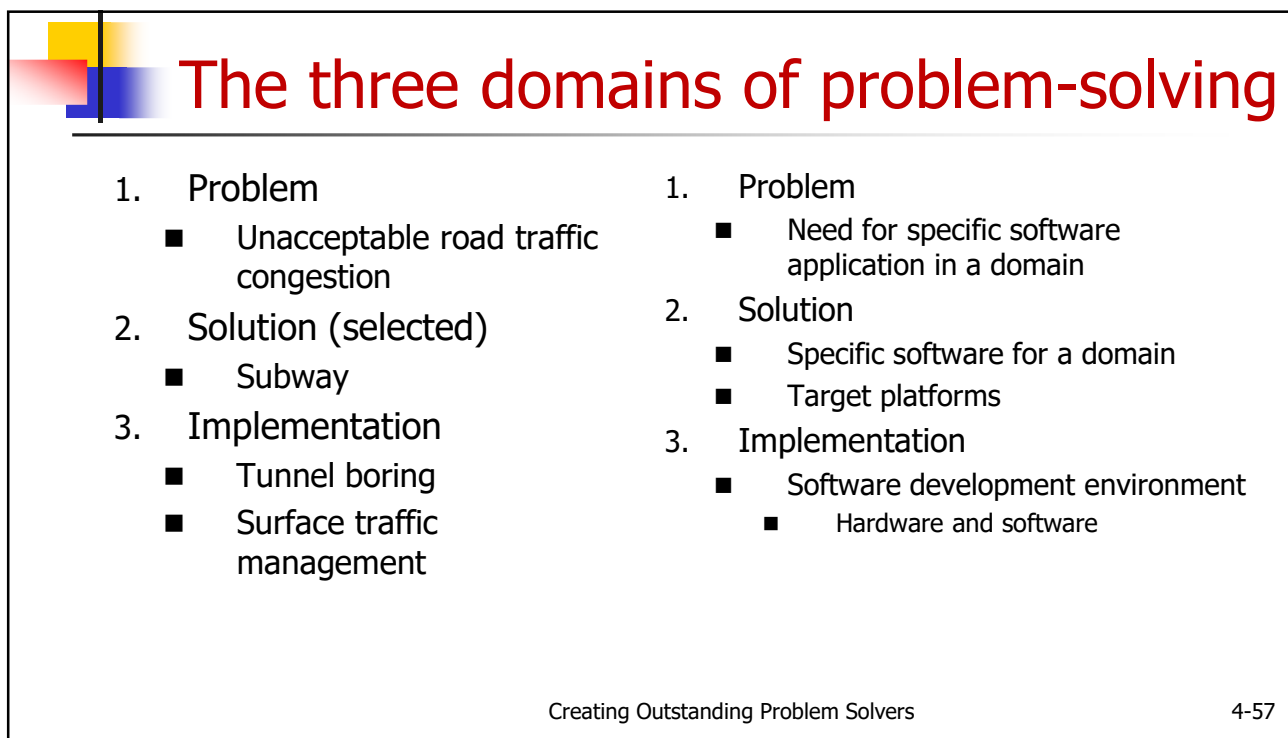
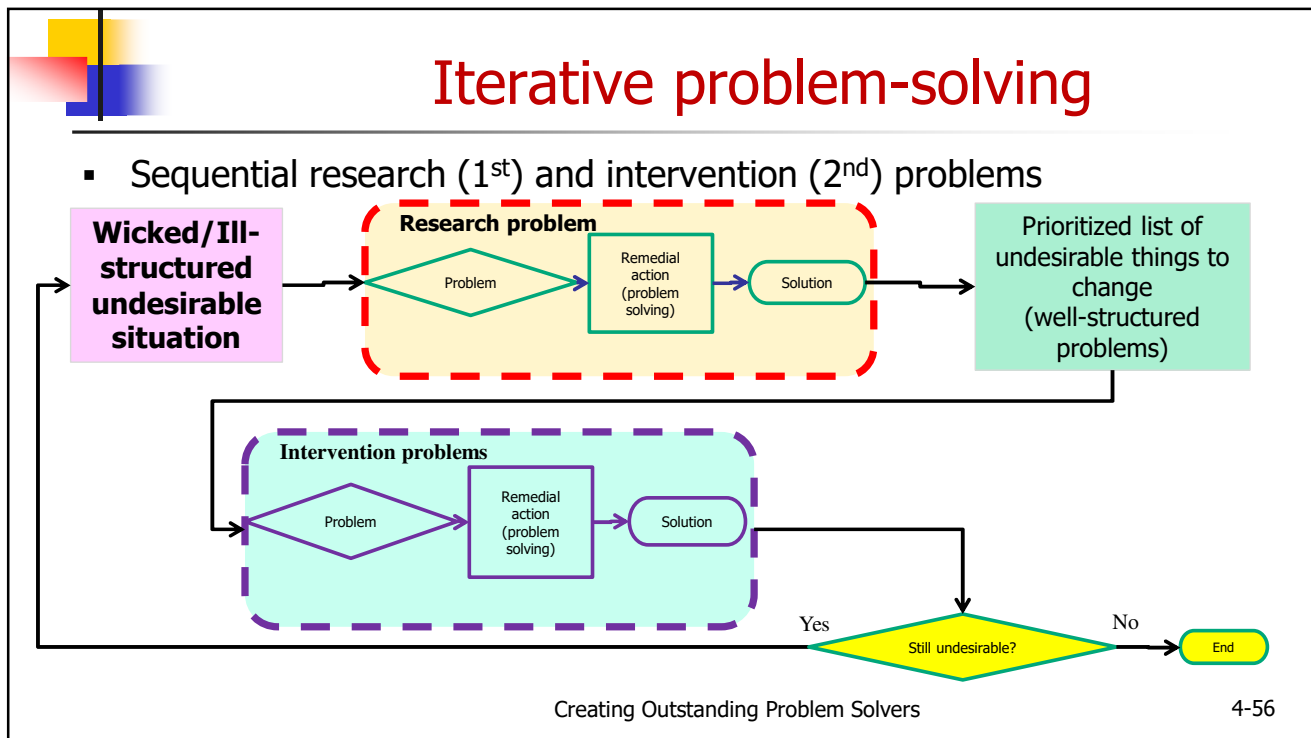


Two problem-solving processes in series

- First
 - Research
 - Develops understanding of problematic situation
 - Defines the problem (remedy the root cause(s) of undesirability)
 - Visualizes the FCFDS and transition plan
- Second
 - Intervention
 - Performs transition to create/realize FCFDS according to the plan

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4-55





Topics

- Properties of a good problem statement
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- **The COPS Problem Formulation Template (PFT) and why you should start using it today**
- Exercises

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COPS 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

- **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

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Why you should start using it today

- Systemic and systematic approach
- Brings out assumptions
- Separates “what” and “how”
 - Encourages operational thinking (“what”) before the functional and structural (“how”)
- Minimizes risk of selecting an infeasible solution
 - Provides a visualization of entire problem-solving process up front
 - Infeasible = a “what” without a “how”
- Full knowledge of “what” needs to be done
 - Overcomes stress of not knowing what to do in specific situations

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Simple problem-1

1. *The undesirable situation*

- Need to make the boss a cup of coffee

2. *Assumptions*

- The ingredients are available

3. *The Feasible Conceptual Future Desirable Situation (FCFDS)*

- The boss is drinking her coffee and is not complaining about it

4. *The problem (what to do)*

1. The boss is drinking her coffee and is not complaining about it
2. Giving the coffee to the boss
3. Stirring the mixture
4. Adding sweetener and creamer
5. The remaining steps to create the cup of hot coffee

Working backwards
from the answer

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Simple problem-2 (how)

5. *The solution (for percolated coffee)* 5. *The solution (for instant coffee)*

- | | |
|--|--|
| 1. Putting water in percolator | 1. Putting water in kettle |
| 2. Putting coffee beans in percolator | 2. Boiling the water |
| 3. Turning on the percolator | 3. Putting the hot water in the cup |
| 4. Percolating the coffee | 4. Adding the coffee |
| 5. Pouring coffee into cup | 5. Adding sweetener and creamer |
| 6. Adding sweetener and creamer | 6. Stirring the mixture |
| 7. Stirring the mixture | 7. Giving the cup of coffee to the boss |
| 8. Giving the cup of coffee to the boss | 8. The boss is drinking her coffee and is not complaining about it |
| 9. The boss is drinking her coffee and is not complaining about it | |

Bonus – add risk management

8. Risk of running out of ingredients
9. Check amounts of coffee, sweetener and creamer
10. Reorder when necessary

Topics

- Properties of a good problem statement
- Classification of problems
- The domains of the problem
- The Problem Formulation Template
- **Exercises**

Exercise 4-21

1. Formulate the problems posed by the following exercises according to the problem formulation template
 1. Exercise 0-1
 2. Exercise 1-31
 3. Exercise 2-1
 4. Exercise 3-31
 5. Exercise 4-21
2. Prepare a presentation to contain (<5 minute)
 1. This slide
 2. The version number of the lesson
 3. The COPS problem formulation templates for each exercise listed above
 4. Lessons learned
 5. Compliance matrix
3. Save as a PowerPoint file as Exercise4-21-abcd.pptx
4. Post/email presentation as, when and where instructed

Back up slides

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Summary

- Properties of a good problem statement
- Classification of problems
- The domains of the problem
- The Problem Formulation Template
- A systemic and systematic approach to finding out-of-the-box solutions
- Exercises

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Meeting the objectives

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

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Any questions ?

1. Best
2. Worst
3. Missing



Email: beyondsystemsthinking@yahoo.com

Subject: <class title> BMW Lesson #

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4-67