The top three tools for systems thinkers

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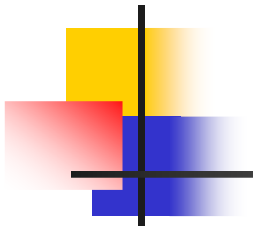
Rev 1.0.0

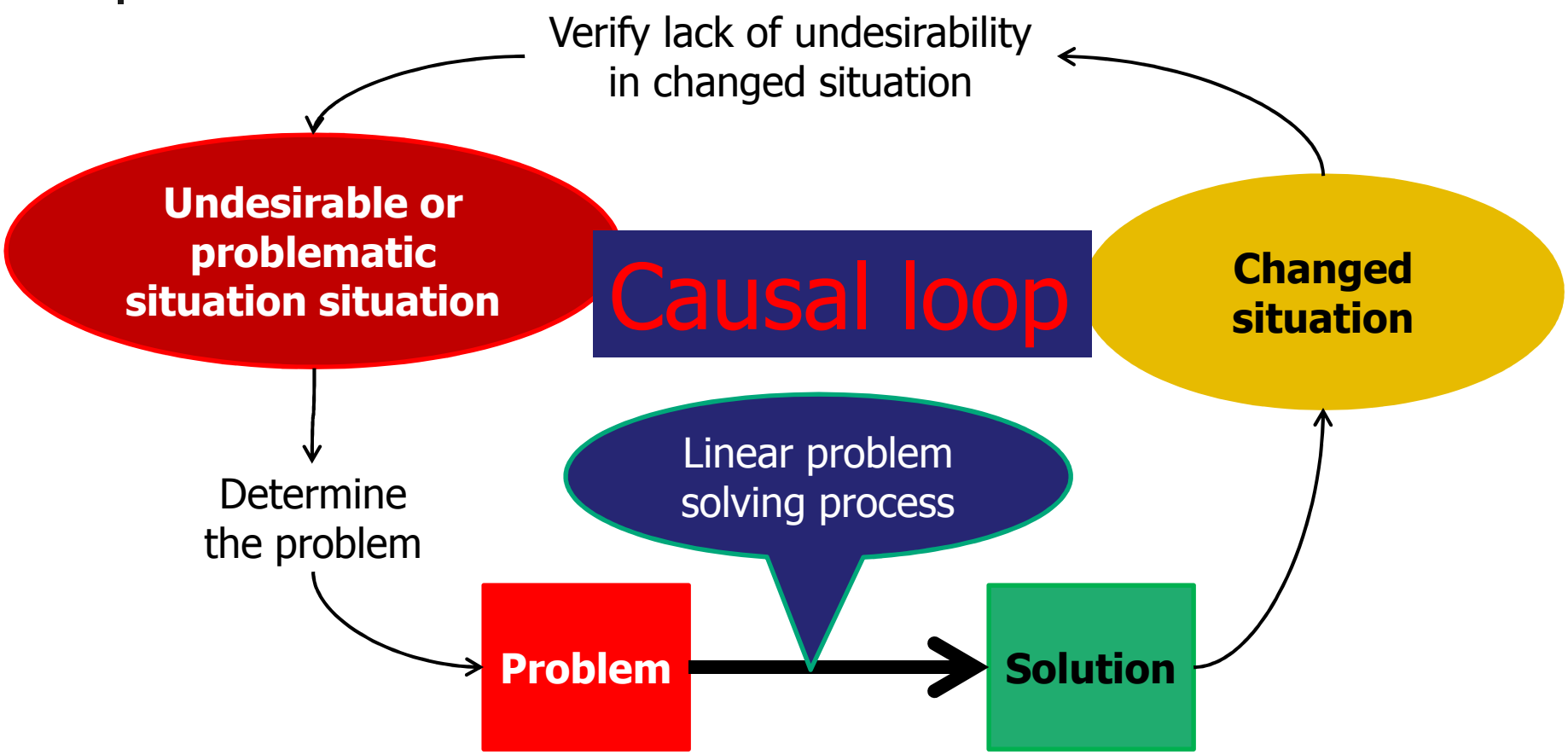


Topics

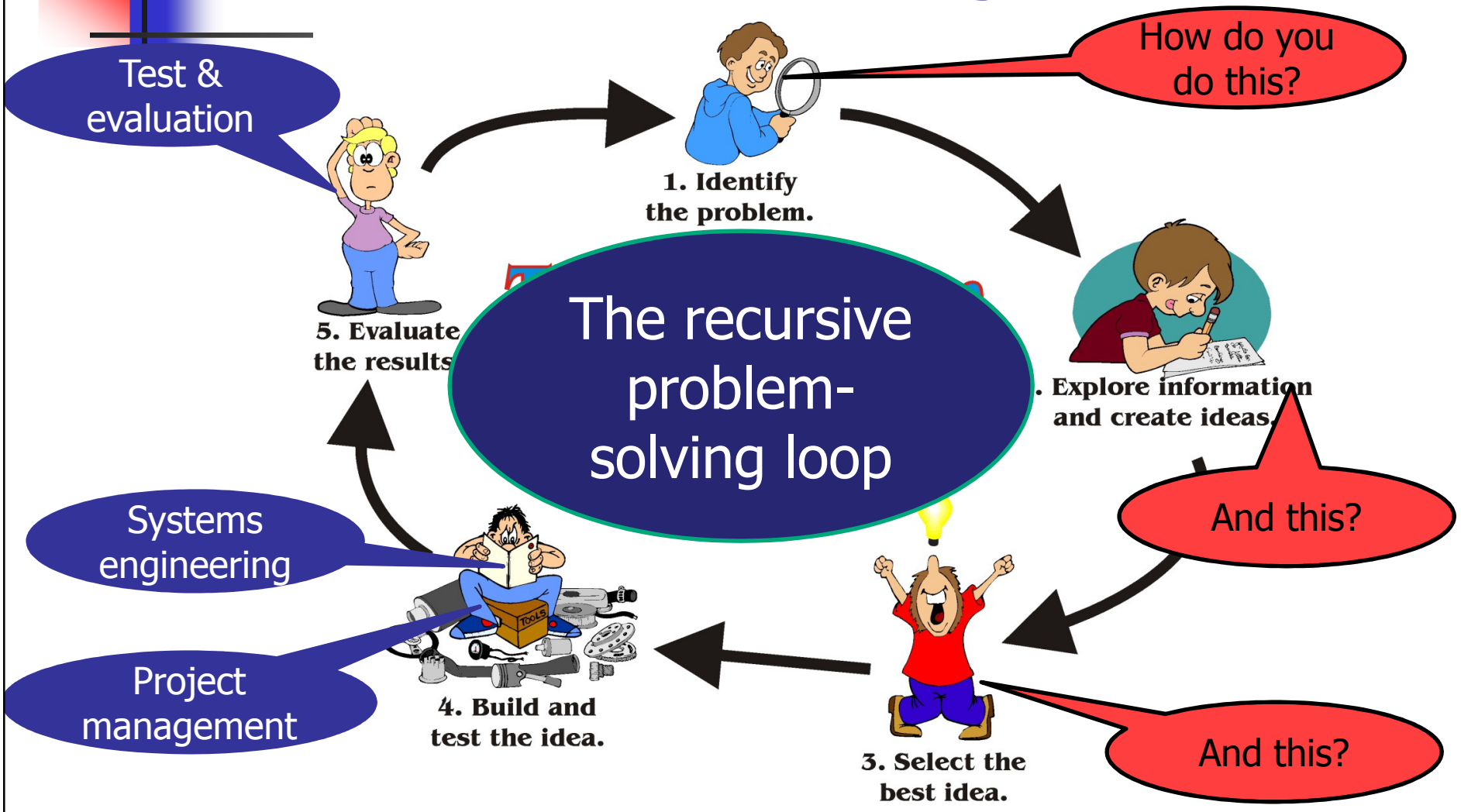
The context is problem-solving

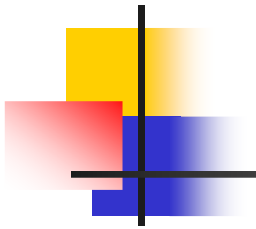
1. System and non-systems approaches
2. Systems Thinking
    1. Systemic Thinking
    2. Systematic Thinking
3. Top three tools and how to use them
4. Summary

The problem-solving process



That's not an original idea





The Non-Systems approach

1. Examine the undesirable situation
   - Might use "Five Why's"
2. Determine the problem
3. Conceptualize a solution
4. Perform the transition from the undesirable situation to the solution
5. Ensure the solution does not have any undesirability
   - Acceptance test
   - Operational test

The "Systems thinker's" approach (many if not most instances)

1. Examine the undesirable situation
   - Use Causal Loops to understand relationships
2. Understand the situation
3. Determine the problem
4. Conceptualize a solution
5. Perform the transition from the undesirable situation to the situation
6. (sometimes) Ensure the new situation does not have any undesirability

The Systems approach

1. Examine an undesirable situation from **a number** of perspectives
    1. List actors, issues and relationships
2. Understand the situation
3. Determine root cause of undesirability
    - The problem is to eliminate the root cause(s)
4. Conceptualize a **number of situations** without the undesirability (**feasible** desirable situations)
5. **Select** one situation
6. Perform the transition from the undesirable situation to the selected feasible desirable situation
7. Ensure the new situation does not have any undesirability

Do this in a systemic and systematic manner

What are the top three tools?

1. Systemic
    1. Lists
    2. The Perspectives Perimeter
2. Systematic
    1. Lists
    2. The Kipling questions
    3. The problem-solving process
3. Holistic
    1. Lists
    2. Active Brainstorming
    3. Idea Storage Templates
    4. The Problem Formulation Template

Perspectives Perimeter (PP)

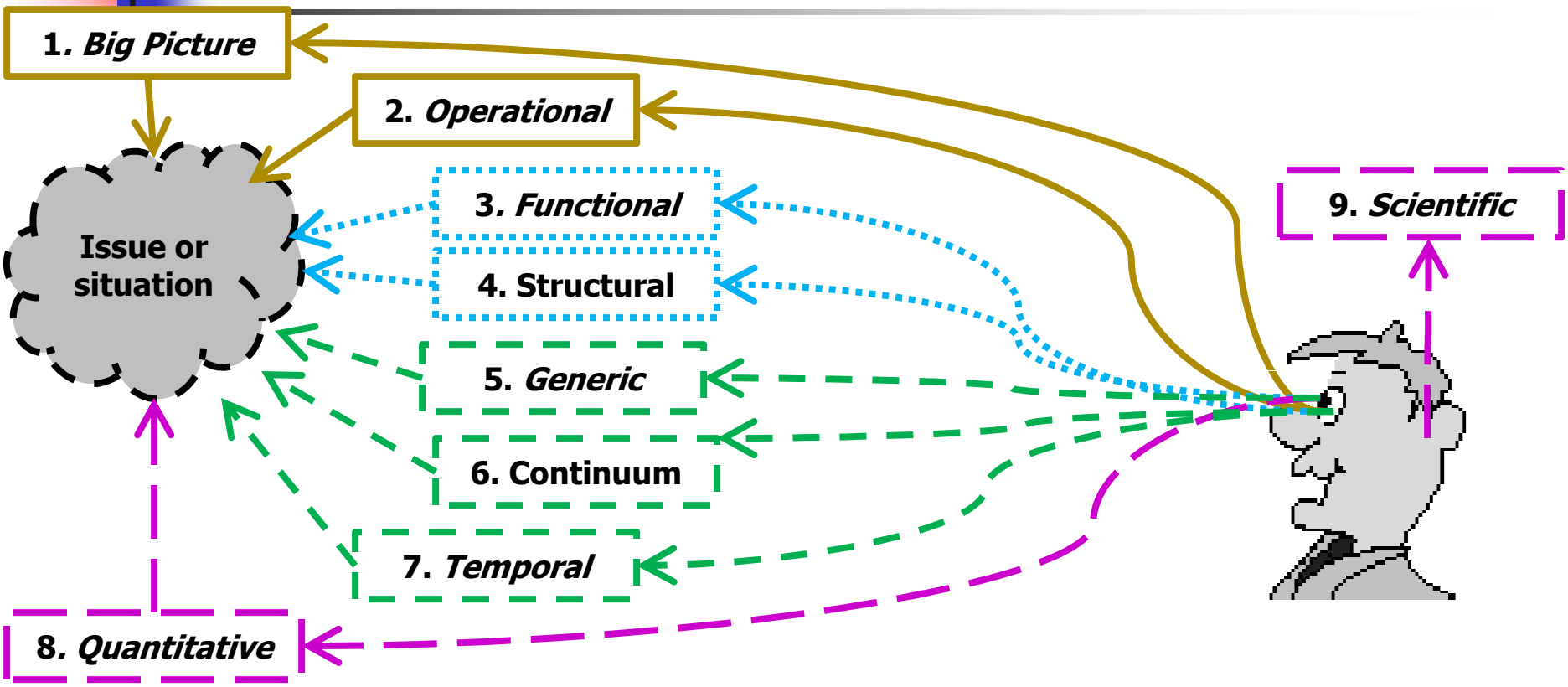
- Provides the advantage of multiple views
- Minimizes communication errors
- Maximizes shared meaning
- Ensures everybody is on the same page or wavelength
- Provides an understanding why there might be misunderstandings and misinterpretation
- Reduces complexity by providing a framework for sets of perspectives
  - List
- Provides a template for storing information
  - Ideal for case studies

Limits of a single perspective*

"People who learn to read situations from different (theoretical) points of view have an advantage over those committed to a fixed position. For they are better able to recognize the limitations of a given perspective. They can see how situations and problems can be framed and reframed in different ways, allowing new kinds of solutions to emerge"

Morgan, G., *Images of Organisation*, SAGE Publications, Thousand Oaks, CA, 1997

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	

External and internal perspectives

- **External perspectives:**
  - **(traditional systems thinking)**
  1. ***Big Picture:*** the context for the system and any assumptions pertaining to the system
  2. ***Operational:*** what the system does:
     - a black box perspective
     - **Causal loops**
- **Internal perspectives:**
  - **(traditional analysis)**
  3. ***Functional:*** what the system does and how it does it
     - a white box perspective
     - **Causal loops**
  4. ***Structural:*** how the system is constructed and organized

Progressive and remaining perspectives

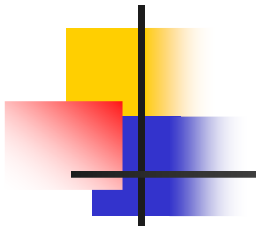
- **Progressive perspectives:**
  5. ***Generic***: where the system is perceived as an instance of a class of similar systems
     - **Out of the box**
  6. ***Continuum:*** where the system is perceived as but one of many alternatives; differences
     - **Out of the box**
  7. ***Temporal:*** which perceives the past, present and future of the system
- **Remaining perspectives:**
  8. ***Quantitative:*** the numeric and other quantitative information associated with the system
  9. ***Scientific:*** **a prescriptive perspective**; the hypothesis or guess about the issue, cause and solution

     "e.g. what if we …" ?, " I think that …"

Example: Houses

1. ***Big picture*** – location, purpose, assumptions
2. ***Operational*** – scenarios (Use Cases) of weekday morning, afternoon, evening, as well as weekend and holiday activities
3. ***Functional*** – functions performed in scenarios
   - e.g. eating, sleeping, reading, talking, accessing the Internet, etc.
4. ***Structural*** – electrical, plumbing, heating, cooling, etc.
5. ***Generic*** – similarity with other houses and buildings and structures serving same purpose (e.g. tents, apartments)
6. ***Continuum*** – differences from other houses and buildings and structures serving same purpose (e.g. tents, apartments)
7. ***Temporal*** – evolution of houses over time
8. ***Quantitative*** – numbers of rooms, costs, prices, land size, etc,
9. ***Scientific*** – depends on problem/issue

Think differently



- Debate
  - A well-trained manager (in management) can manage any type of project in any domain
- *Continuum* perspective
  - ~~Planning,~~ organizing, directing and controlling
  - As along as it goes according to plan
    - no domain knowledge decisions need to be made

The Kipling questions

- What …?
- Where …?
- When …?
- How …?
- Why …?
- Who …?

I have six honest serving men
They taught me all I knew
I call them What and Where and When
And How and Why and Who

(Kipling 1912)

Active Brainstorming: HTP Matrix for triggering ideas

	1	2	3	4	5	6
HTP	**Who?**	**What?**	**Where?**	**When?**	**Why?**	**How?**
Big picture						
Operational						
Functional						
Structural						
Generic						
Continuum						
Temporal						
Quantitative						
Scientific						

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

Constraint mapping (Dunn, 2012)
Matrix for triggering ideas

	1	2	3	4	5	6
Perspective	**Who?**	**What?**	**Where?**	**When?**	**Why?**	**How?**
Physical						
Legal						
Organizational						
Political						
Distributional						
Budgetary						
Other						

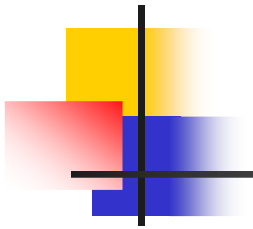
Other: schedule, etc. use as appropriate

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

Constraint mapping (Dunn, 2012) Active Brainstorming

	Physical	Legal	Organizational	Political	Distributional (Benefits)	Budgetary	Other
Big Picture							
Operational							
Functional							
Structural							
Generic							
Continuum							
Temporal							
Quantitative							
Scientific							

Pose Kipling questions in each area of the matrix



Systemic and systematic use of PPs

- Systemic
  - Reuse of same applicable PPs each time
- Systematic
  - Use Active Brainstorming via Kipling Questions
  - According to the problem-solving process
  - Store ideas systemically and systematically

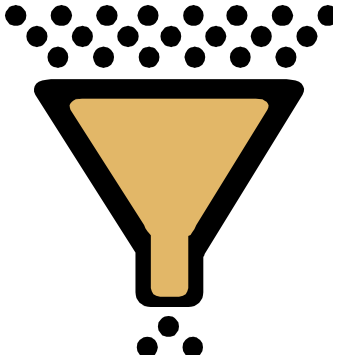
(list of) Idea storage templates (IST)

- Contain Lists of ideas

1. SWOT
2. OARP
   - ideas pertaining to the **problem**
3. FRAT
   - ideas pertaining to the **solution**
4. SPARK
   - ideas pertaining to **implementing the solution**

OARP - Template to focus on Real problem

1. **O**bservations
   - All ideas before sorting
   - Left over ideas after sorting
2. **A**ssumptions
   - Important
3. **R**isks
   - Ideas about reasons activity to remedy the problem could fail
4. **Real P**roblem
   - Ideas about
     - Root cause
     - What has to be changed to change the situation



How assumptions influence actions

http://www.youtube.com/watch?v=qU9sRQBJppks, accessed 3/8/13

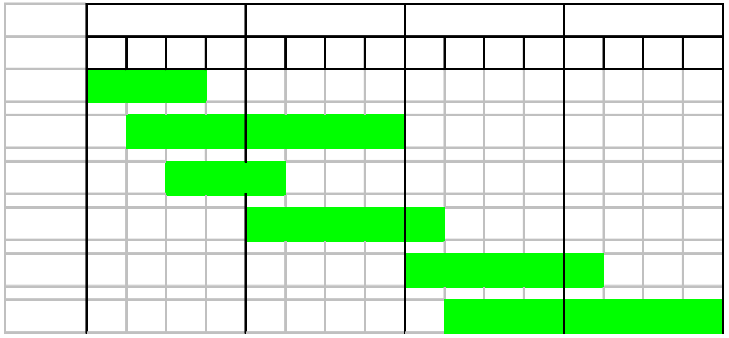
FRAT* focusing on solution

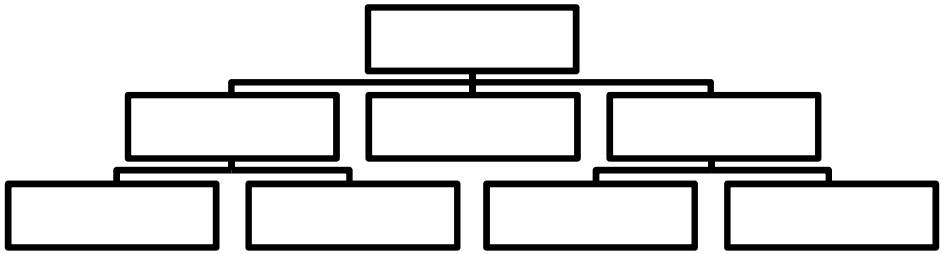
1. **Functions**
   - Ideas about **what** functions the answer/solution must perform
2. **Requirements**
   - Ideas about **how well** each function must be performed
3. **Answers**
   1. Ideas about **feasible** answers/solutions
   2. Ideas describing **how** the answers/solutions will function and
   3. Ideas about managing risk associated with that answer/solution
4. **Tests**
   1. Ideas about evaluation criteria for selecting answers/solutions
   2. Ideas describing how **what** will be done to determine **how well** the answers/solutions perform the needed functions

* Brian Mar (SE Journal Volume 1, number 1)

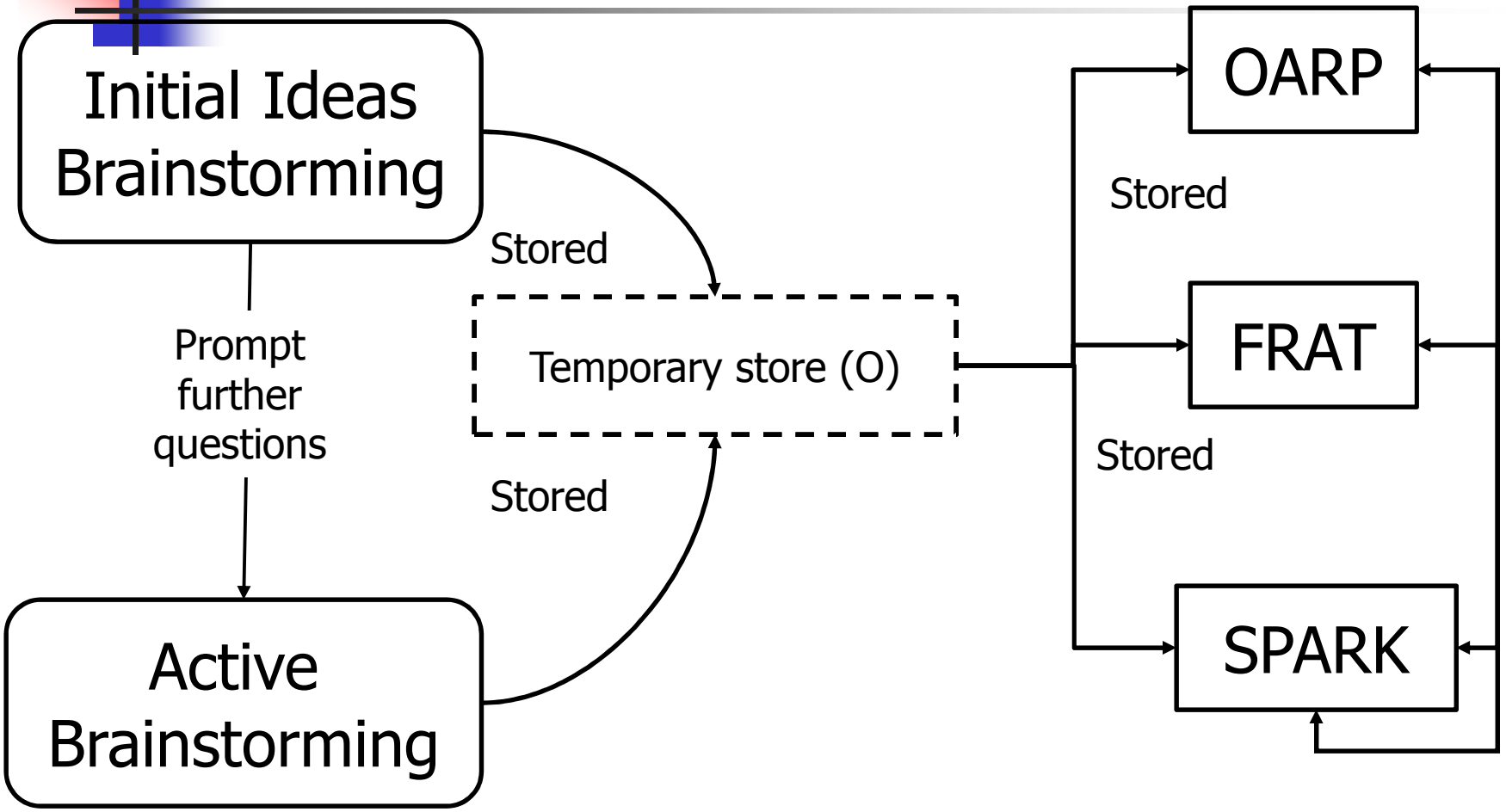
SPARK - activities to resolve problem

- Ideas about
  1. Schedules
  2. Products
  3. Activities
  4. Resources
  5. Risks



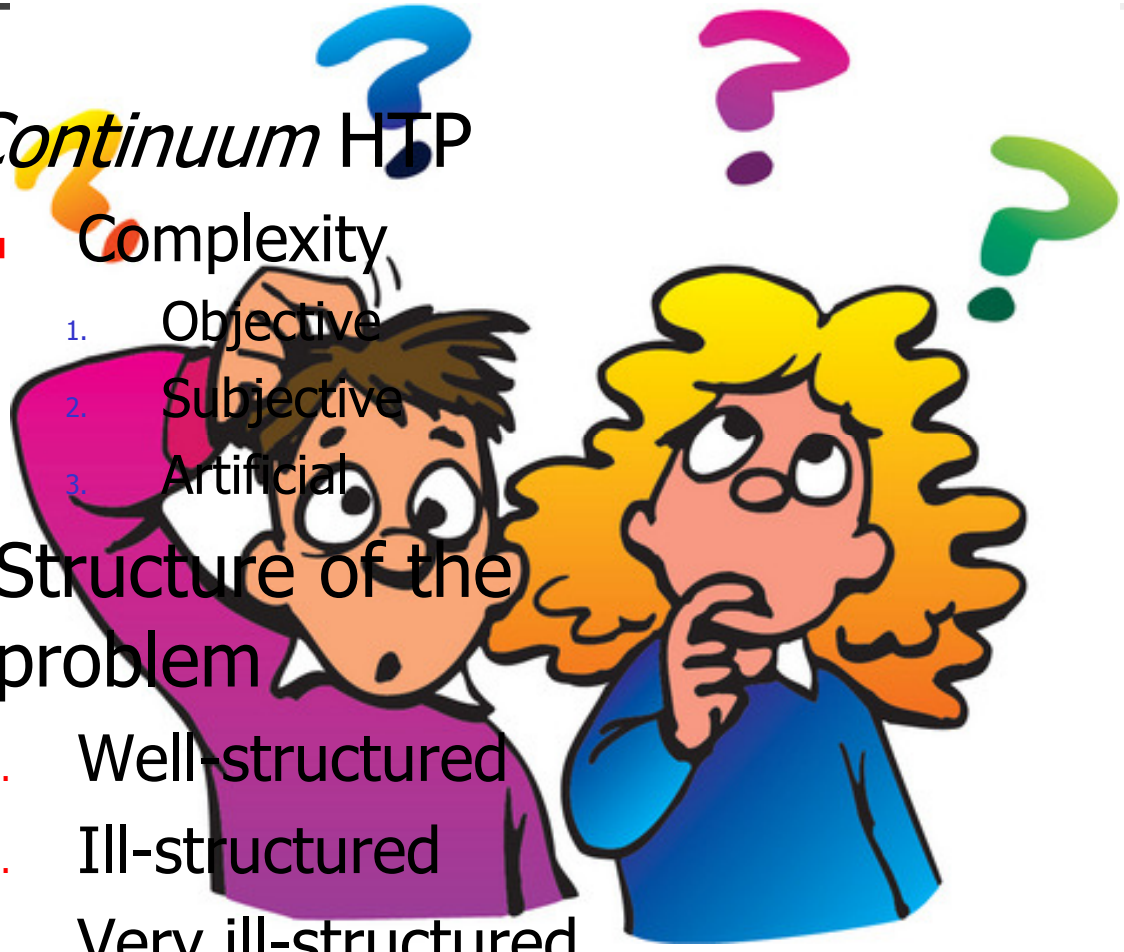


Flow of ideas



Result = Complexity

- *Continuum* HTP
  - Complexity
    1. Objective
    2. Subjective
    3. Artificial
- Structure of the problem
  1. Well-structured
  2. Ill-structured
  3. Very ill-structured
     - Wicked problems



Don't Care

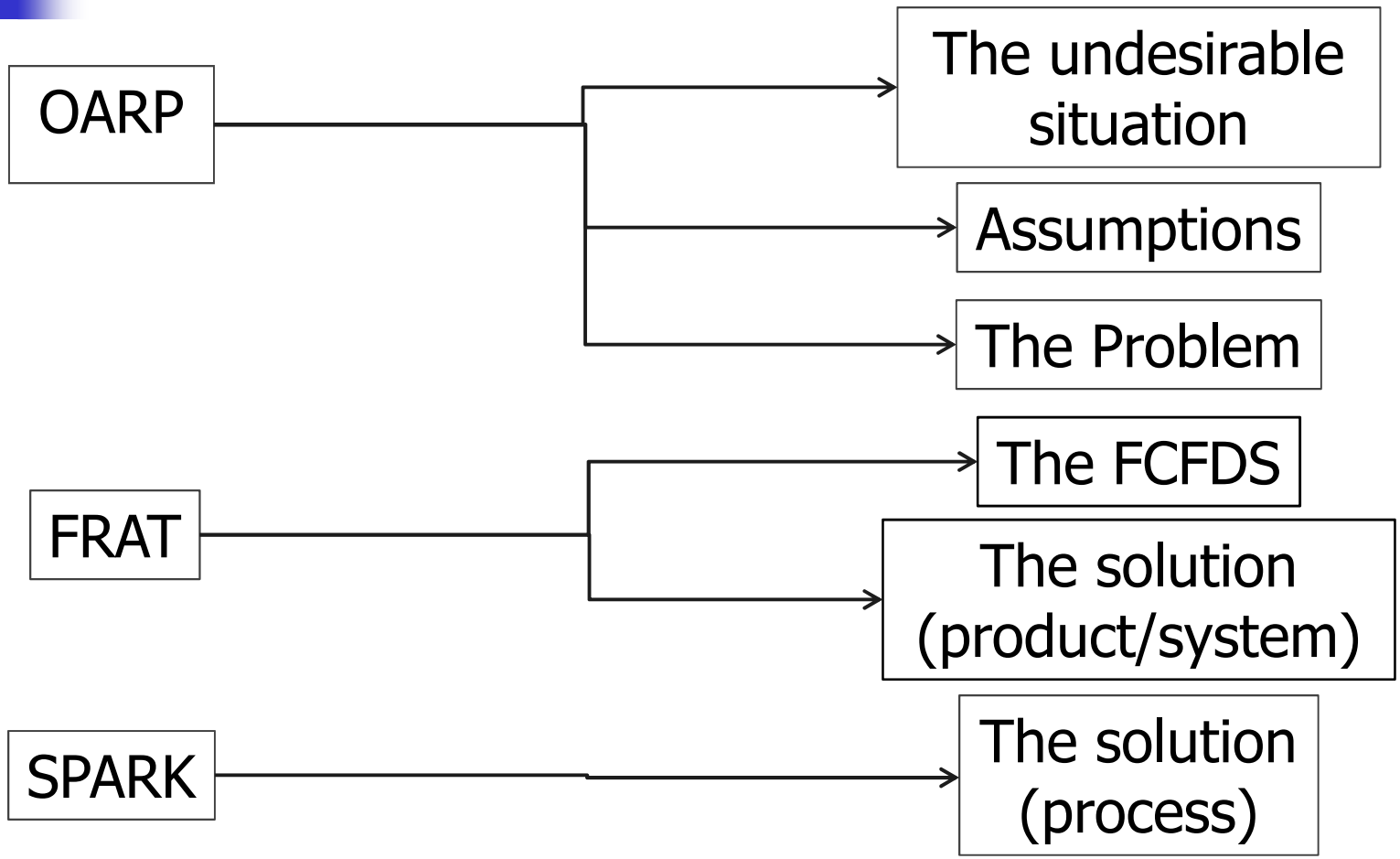
- Simplifies dealing with Objective complexity
- **Systematic thinking tool**
- **Critical thinking tool**
- Requires subject matter expertise
- Removes irrelevant clutter
  - Extracts signals from noise
- Contributes to applying the KISS principle
- For each idea, is it applicable in the situation?
  - Yes, why?, keep it
  - No, why not?
  - Can it be modified for the situation?
  - Store it for future reference (do not throw it away)

How you process ideas from brainstorming

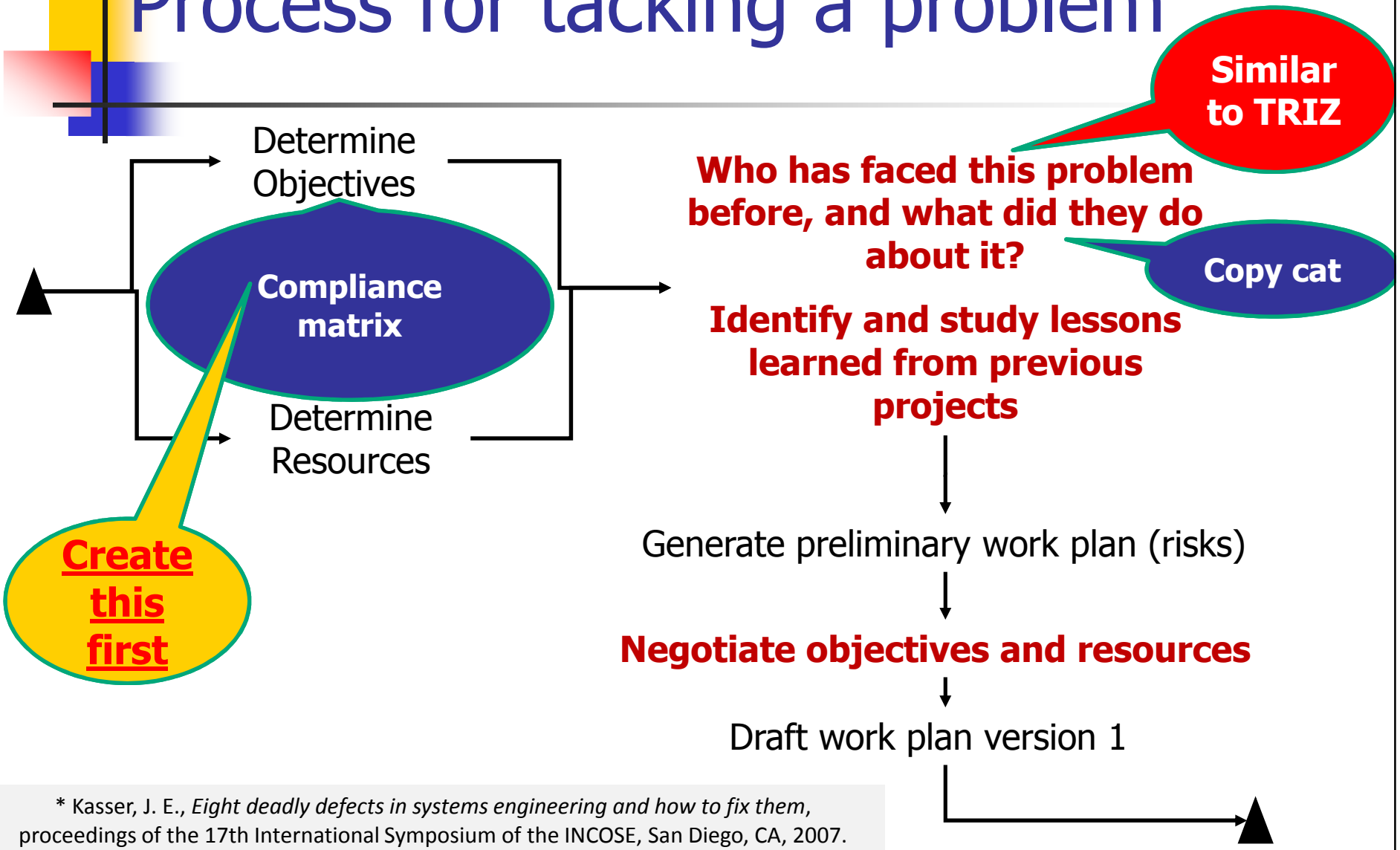
Problem Formulation Template

1. ***The undesirable situation***
   - As perceived by the stakeholders
2. ***Assumptions***
3. ***The FCFDS***
   - As perceived by the stakeholders
   - How we will know the situation is desirable?
4. ***The problem***
   - How to convert the FCFDS to reality
   - List of actions → Compliance Matrix
5. ***The solution***
   - Remedies the undesirable situation
   - Has to be interoperable with evolving adjacent systems over the operational life of solution and adjacent systems
   - Made of two interdependent parts
     a. **Process:**
     b. **Product:**

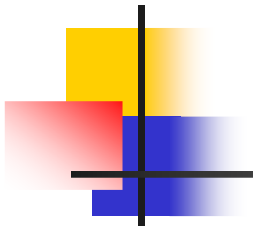
Flow of ideas (more or less)



Process for tacking a problem



* Kasser, J. E., *Eight deadly defects in systems engineering and how to fix them*, proceedings of the 17th International Symposium of the INCOSE, San Diego, CA, 2007.



Compliance matrix

- List of what needs to be done
  - Top tool
  - Space for list of where it is to be/was done
- Tabular format

To be done	Where is ... done
Make presentation	SWissEd

Working backwards from solution

PAM Charts

GANTT and PERT Charts

Prepare it like this

1. Make presentation
2. Travel to SWissED
3. Arrange travel
4. Arrange accommodation
5. Prepare presentation

List it like this

1. Prepare presentation
2. Arrange travel
3. Arrange accommodation
4. Travel to SWissED
5. Make presentation

Each step has its own Problem Formulation Template

What is missing?

Summary

The context was problem-solving

1. System and non-systems approaches
2. Systems Thinking
    1. Systemic Thinking
    2. Systematic Thinking
3. Top three tools and how to use them
    1. More than three
    2. Which are the top three?
    3. It depends what you are thinking about

Questions and comments