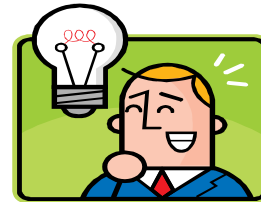


Systems Thinking and Beyond Module 3 Session 2 of 3: Holistic thinking: Systems Thinking And Beyond



Rev 3.0.3



Creating Outstanding Systems Thinkers

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Knowledge component



- Lecture
 - Overview and summary of readings
- 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-ICYSmGk>
- Exercises

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Topics

- **Emergence**
- Hierarchies of systems
- Storing information in the HTPs
- Active brainstorming
- Exercises



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Emergence

- The process of coming forth, issuing from concealment, obscurity, or confinement*
 - * Oxford English dictionary
- Functionality emerges from the components and the interactions between the components
 - Example
 - Wires, transparent container, inert gas or vacuum
 - Power source
- Property of a system as a whole, not of a component
- Principle: a property of level in hierarchy that is not observed at a lower level



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Emergent properties

1. Known at design time

1. **Desired** – being the purpose of the system
2. **Undesired** – based on experience and should be
 1. designed out
 2. compensated for
3. **Don't care**

2. Unknown at design time

1. **Undesired** – functionality performed by the system that is undesired, also known as 'side effects'.
2. **Serendipitous** – beneficial and desired once discovered, but not part of the original specifications
3. **Don't care**

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Topics

- Emergence
- **Hierarchies of systems**
- Storing information in the HTPs
- Active brainstorming
- Exercises



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Principle of Hierarchies*

1. *“All complex structures and processes of a relatively stable character display hierarchical organisation regardless of whether we consider galactic systems, living organisms and their activities or social organisations”* (Koestler 1978: page 31).

2. *“Once we adopt the general picture of the universe as a series of levels of organisation and complexity, each level having unique properties of structure and behaviour, which, though depending on the properties of the constituent elements, appear only when those are combined into the higher whole, we see that there are qualitatively different laws holding good at each level”* (Needham, 1945) cited by (Koestler 1978: page 32).

*STT Section 3.2.7

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Principle of Hierarchies*

- Each level organizes the level below it plus one or more emergent qualities (or unpredictable novelties).
- The mechanism of an organization is found at the level below, its purpose at the level above.
- Knowledge of the lower level infers an understanding of matters on the higher level;
- Qualities emerging on the higher level have no direct reference to the lower-level organization.
- The higher the level, the greater its variety of characteristics, but the smaller its population.
- The higher level cannot be reduced to the lower, since each level has its own characteristic structure and emergent qualities.
- An organization at any level is a distortion of the level below, the higher-level organization representing the figure which emerges from the previously organized ground.
- A disturbance introduced into an organization at any one level reverberates at all the levels it covers.
- Every organization, at whatever level it exists, has some sensitivity and responds in kind

*STT Section 3.2.7

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Using the Principle of Hierarchies

- Keep the systems and subsystems at the same level in the hierarchy of systems.
- Abstract out or hide the internal components of systems and subsystems in any one view
- You only have to deal with three levels
 - Meta level
 - System level
 - Subsystem level
- Remember Miller's Rule

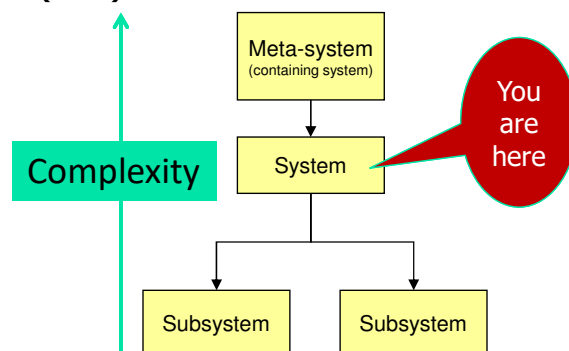
You are
always here

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Hierarchies of systems

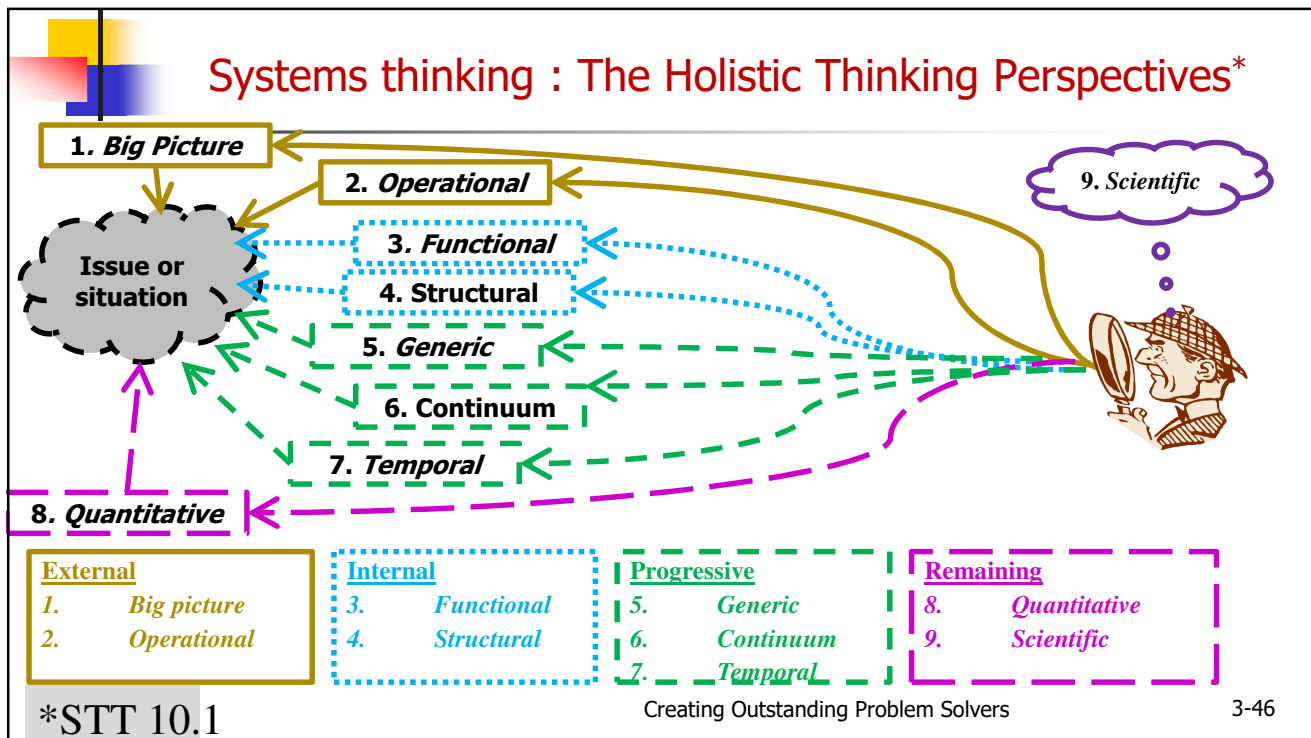
- Integrated Configuration List (ICL)*
 - Assembly
 - Subassembly
 - Component part
- A Specification
 - System
- B Specification
 - Subsystems



* MIL-D-18300.H - Design Examinations, Engineering Avionic Systems/Equipment, General Requirements for, 1970, <http://everyspec.com/MIL-SPECS/MIL-SPECS-MIL-D/download.php?spec=MIL-D-18300H.042296.PDF>, accessed 23 March 2016

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HTP example: Camera

- **Big picture:** where cameras are used and for what purpose
- **Operational:** capturing images, transporting safely, viewing images, adjusting settings, and charging the battery
- **Functional:** capturing images, storing images, retrieving images, deleting images, battery charging functions, etc.
- **Structural:** camera body, camera case and charger
- **Generic:** painting, sketching and other image capture methods/devices
- **Continuum:** different types and models of cameras, different materials used to construct camera
- **Temporal:** evolution of the image capturing media from photographic plates to film to solid-state memory
- **Quantitative:** numbers pixels per inch, lens characteristics, etc.
- **Scientific:** depends on problem or issue

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Thinking about a camera

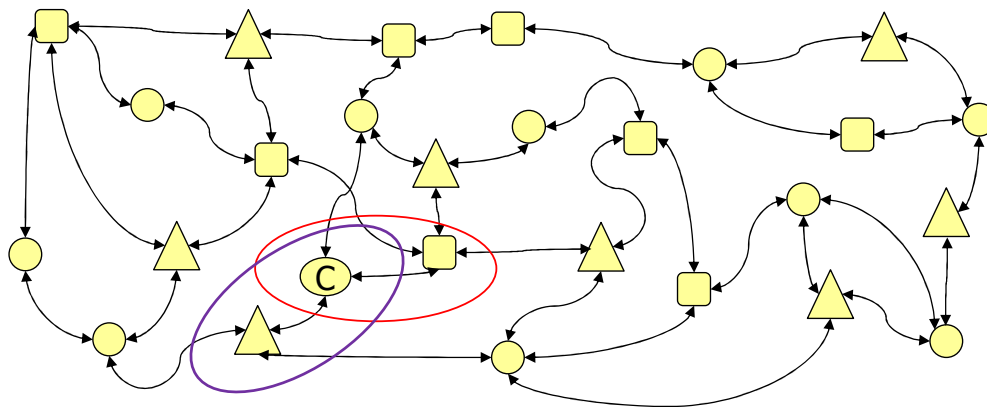
- **Understanding how a camera works**
 - The *Functional* and *Structural* HTPs
 - The system contains the **camera** as a closed system
- **Capturing images**
 - The *Operational* HTP
 - The system contains the **camera and operator** and **whatever is being photographed** as a closed system
- **Transporting camera**
 - The *Operational* HTP
 - The system contains the **camera, operator** and **camera case** as a closed system
- **Recharging a camera**
 - The *Operational* HTP
 - The system contains the **camera, operator and charger** as a closed system

Notice how the system boundary changed

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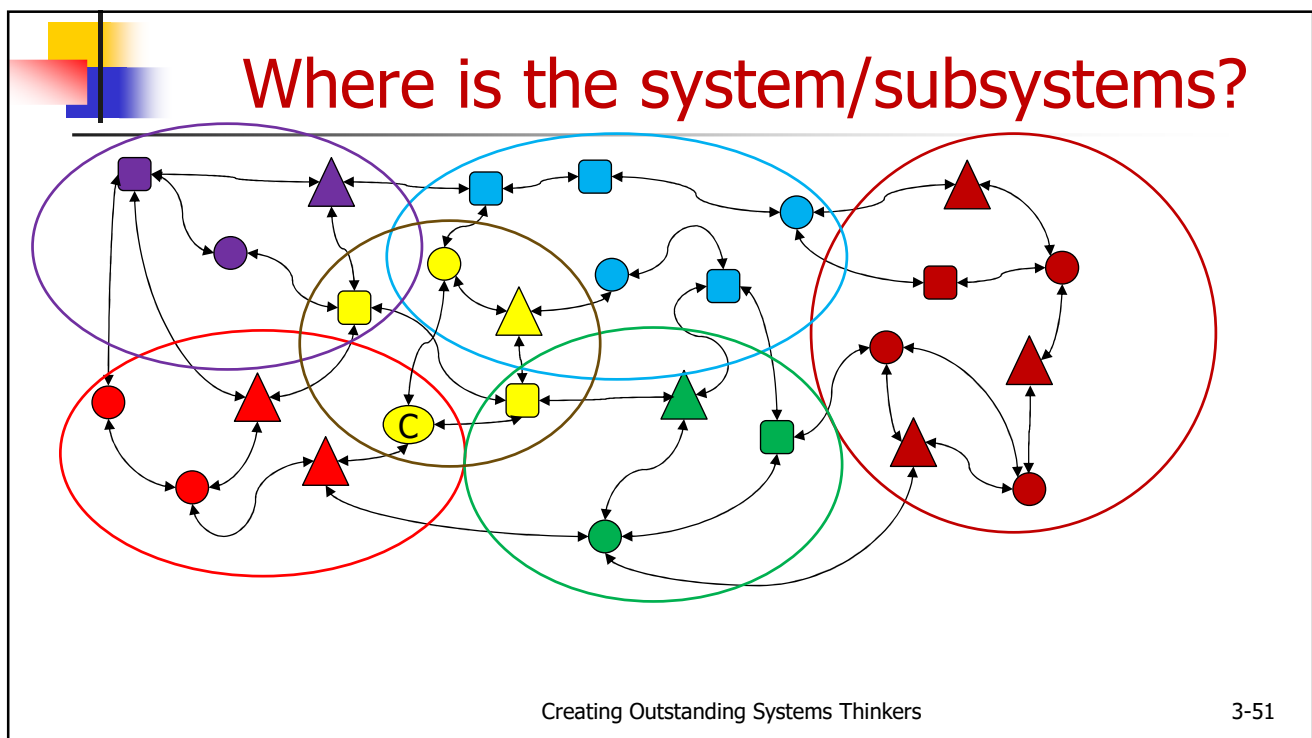
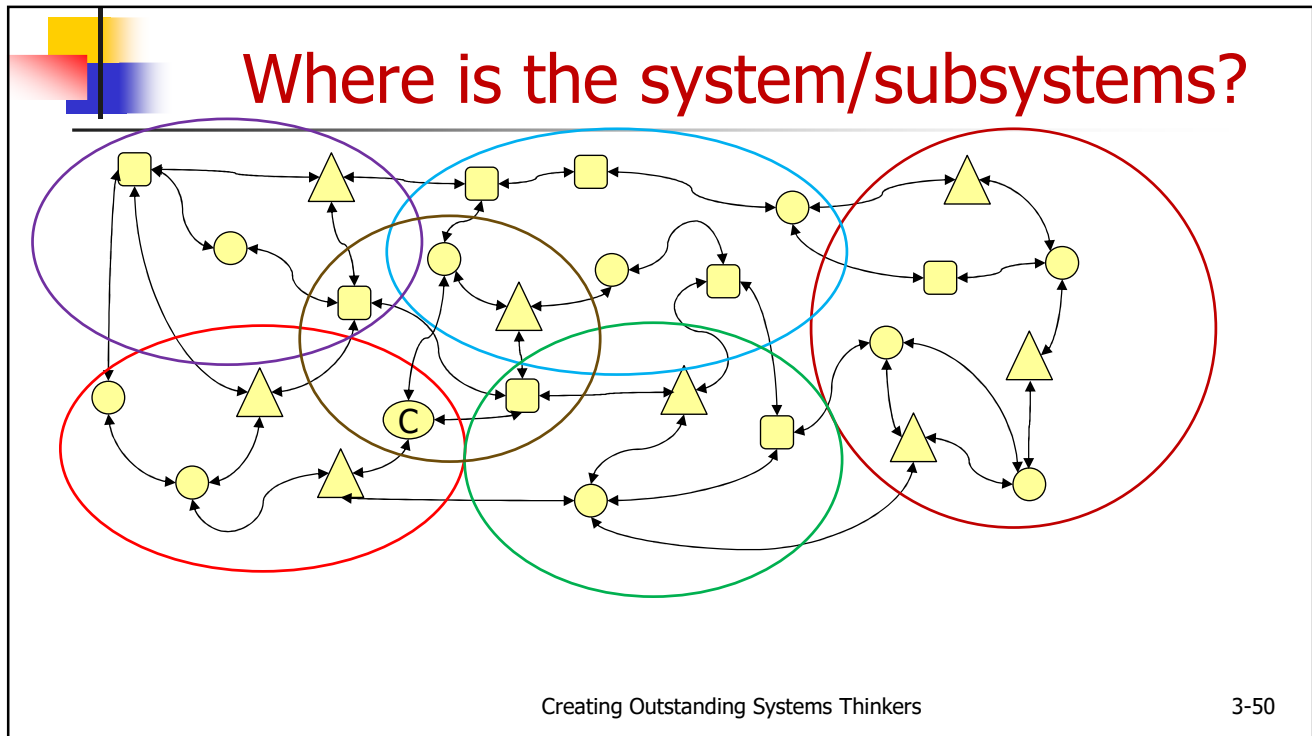
3-48

In general, where is the system?



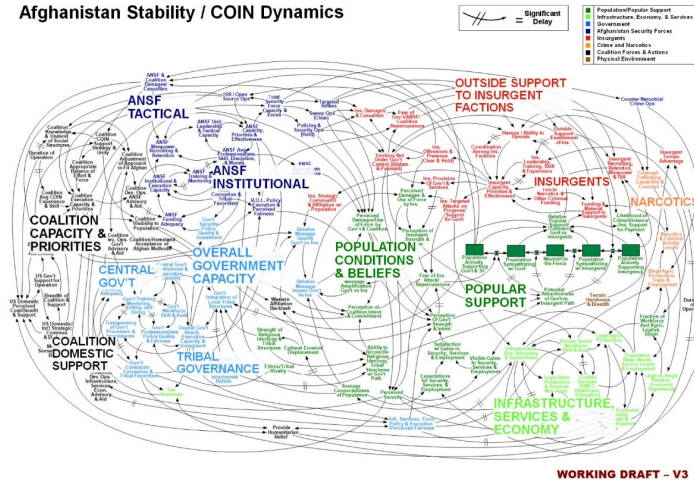
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"When we understand that slide, we'll have won the war," General McChrystal

Afghanistan Stability / COIN Dynamics

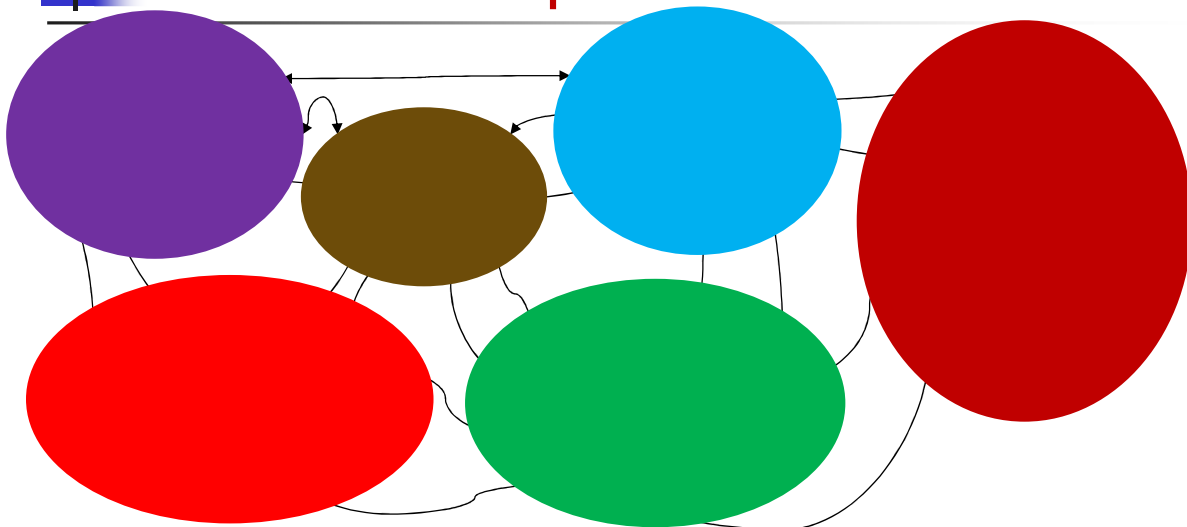


* <http://msnbcmedia.msn.com/i/MSNBC/Components/Photo/2009/December/091202/091203-engel-big-9a.jpg>, accessed 8 April, 2011

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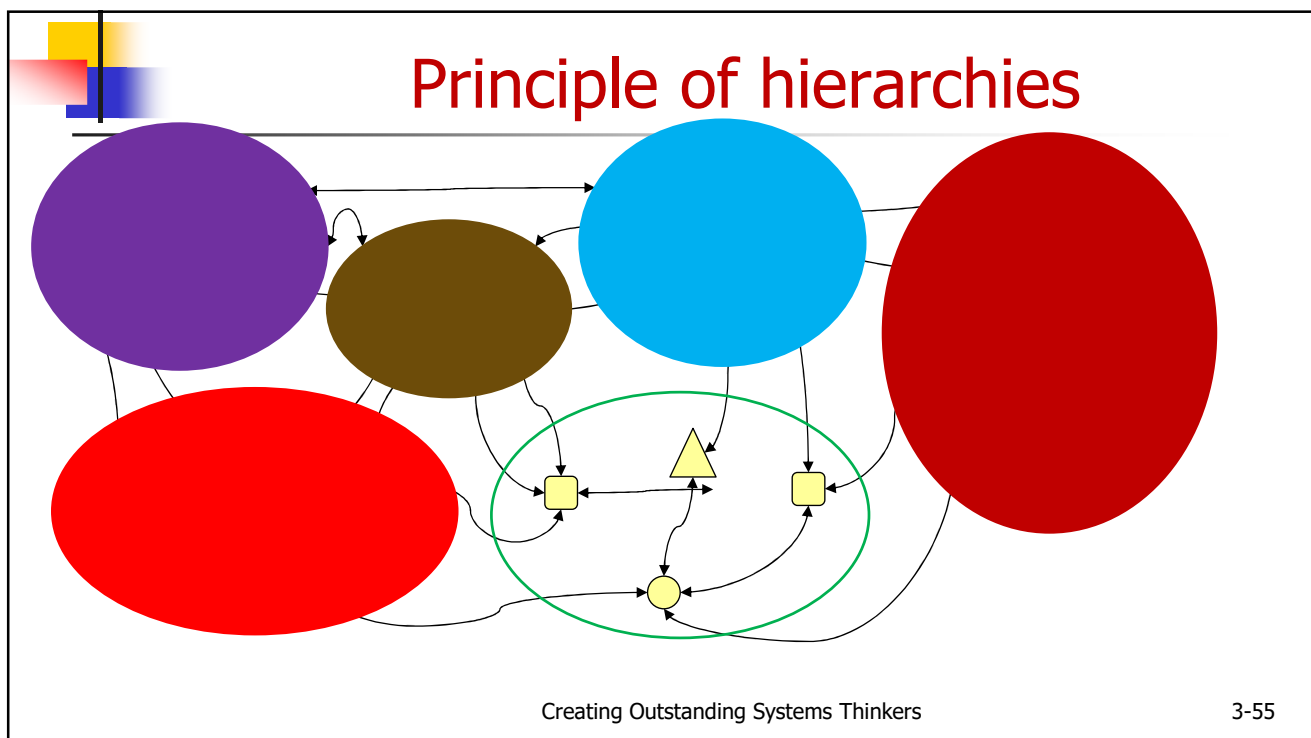
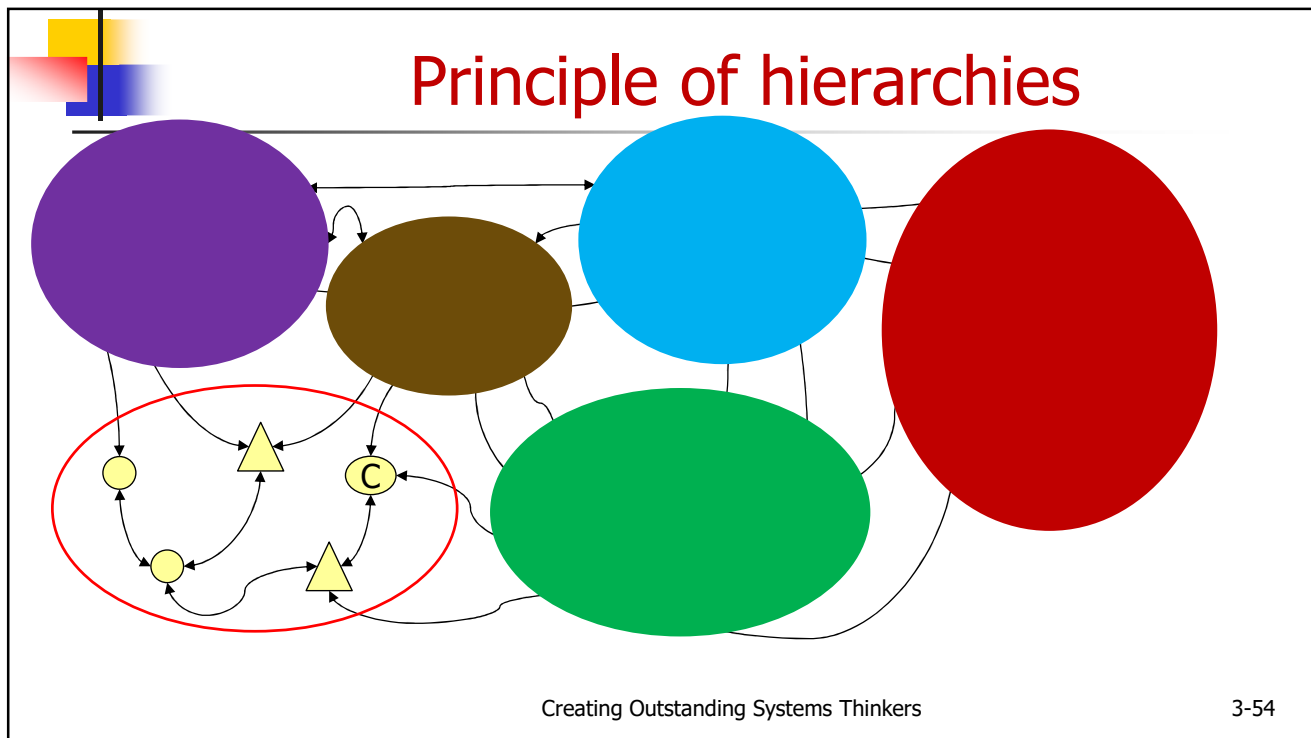
3-52

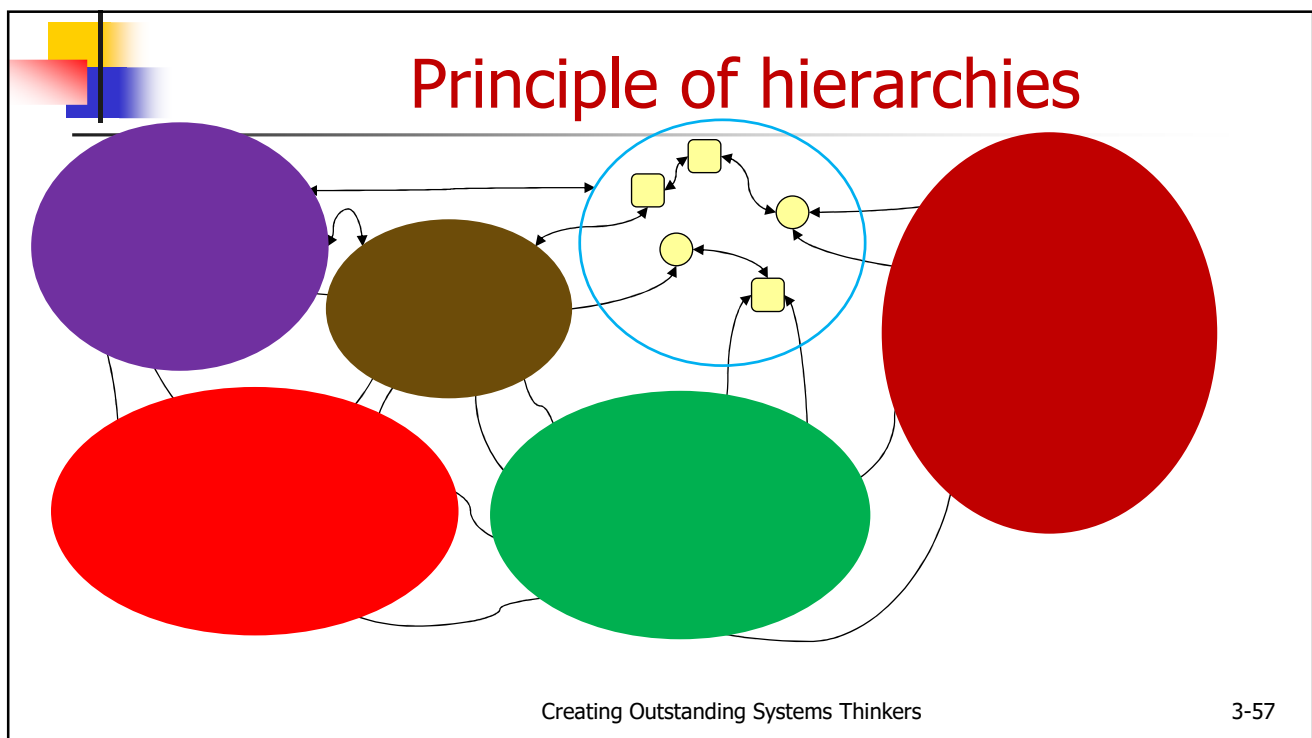
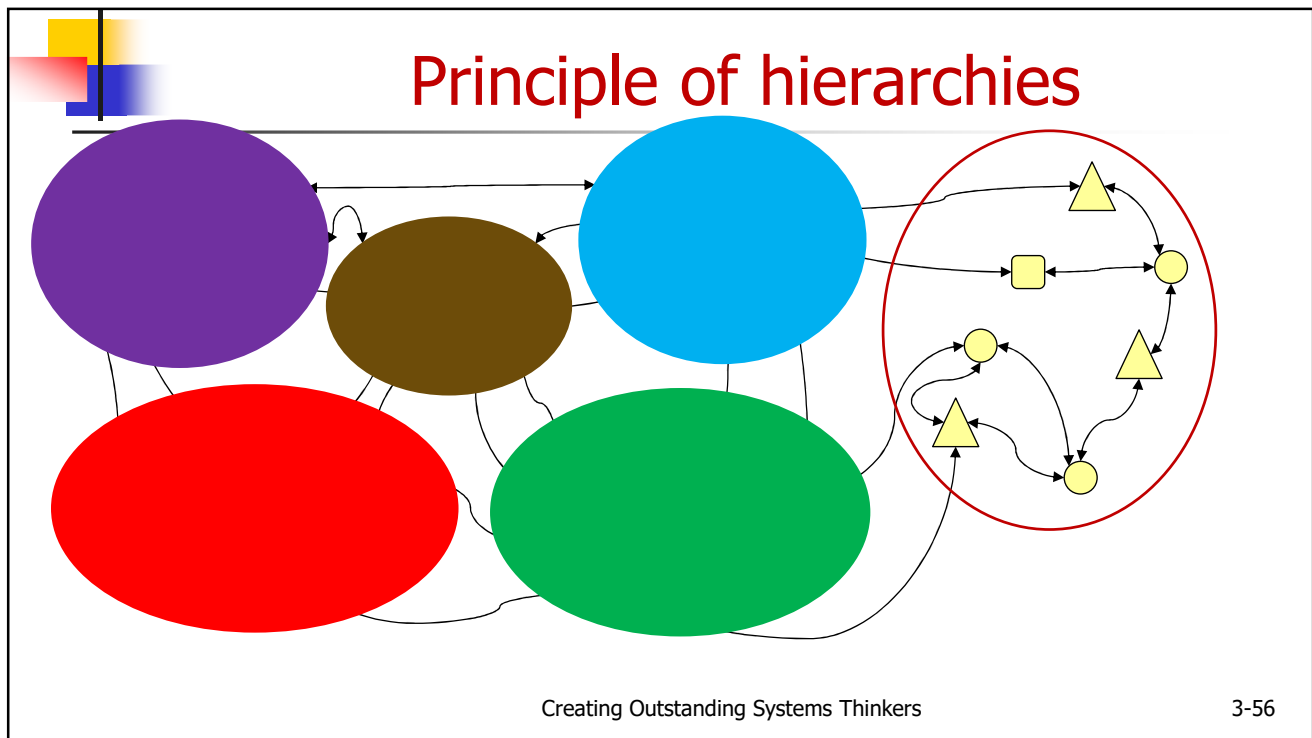
Principle of hierarchies

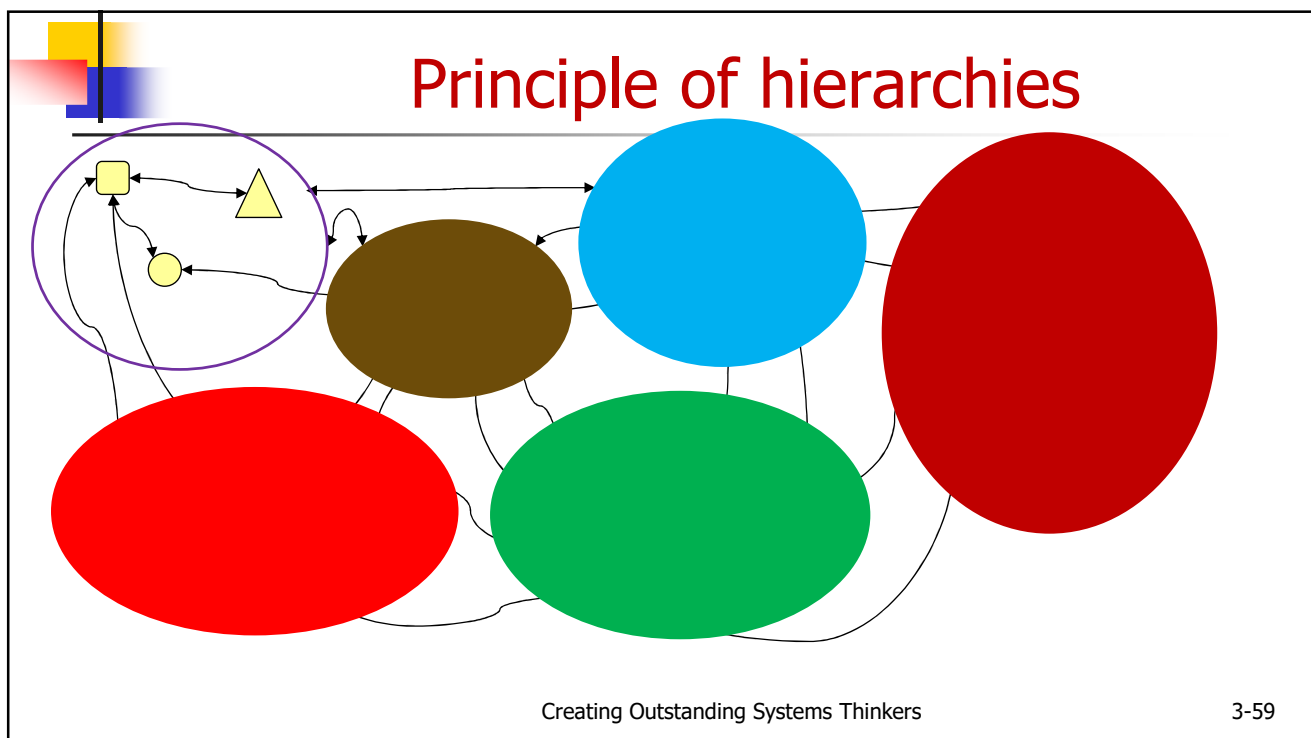
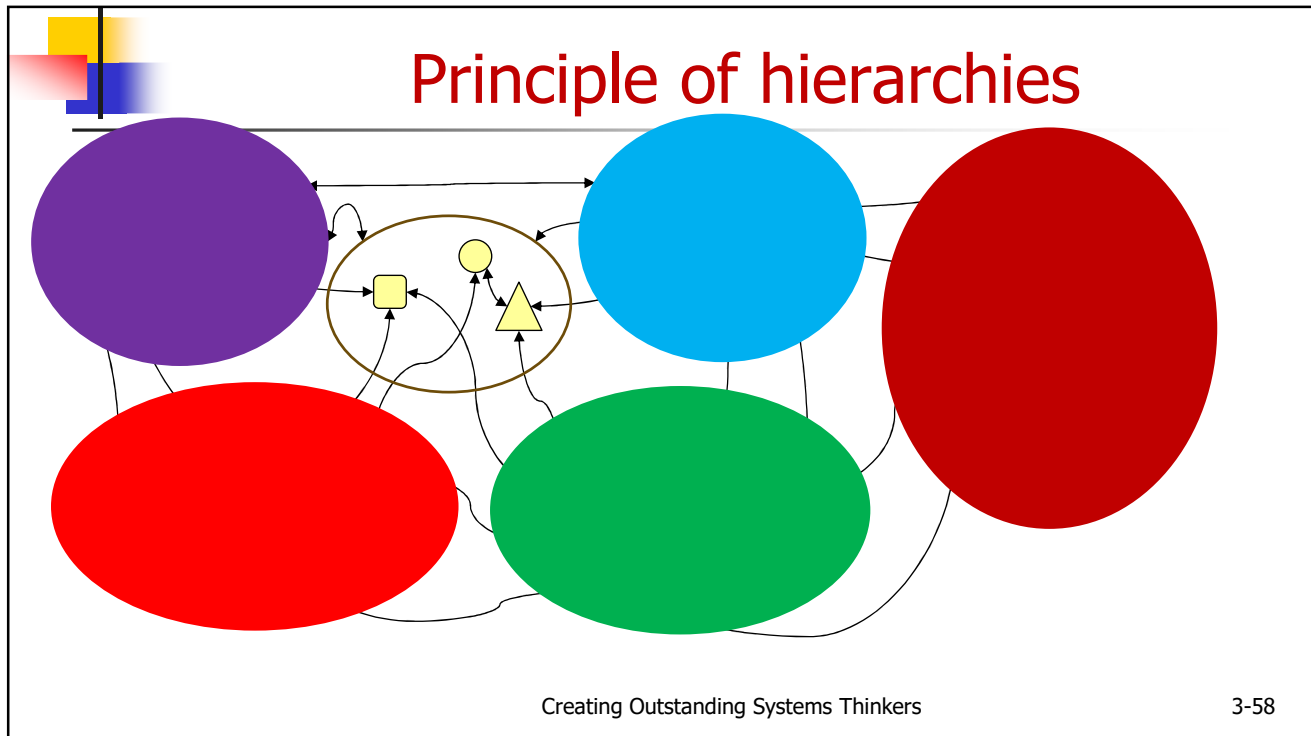


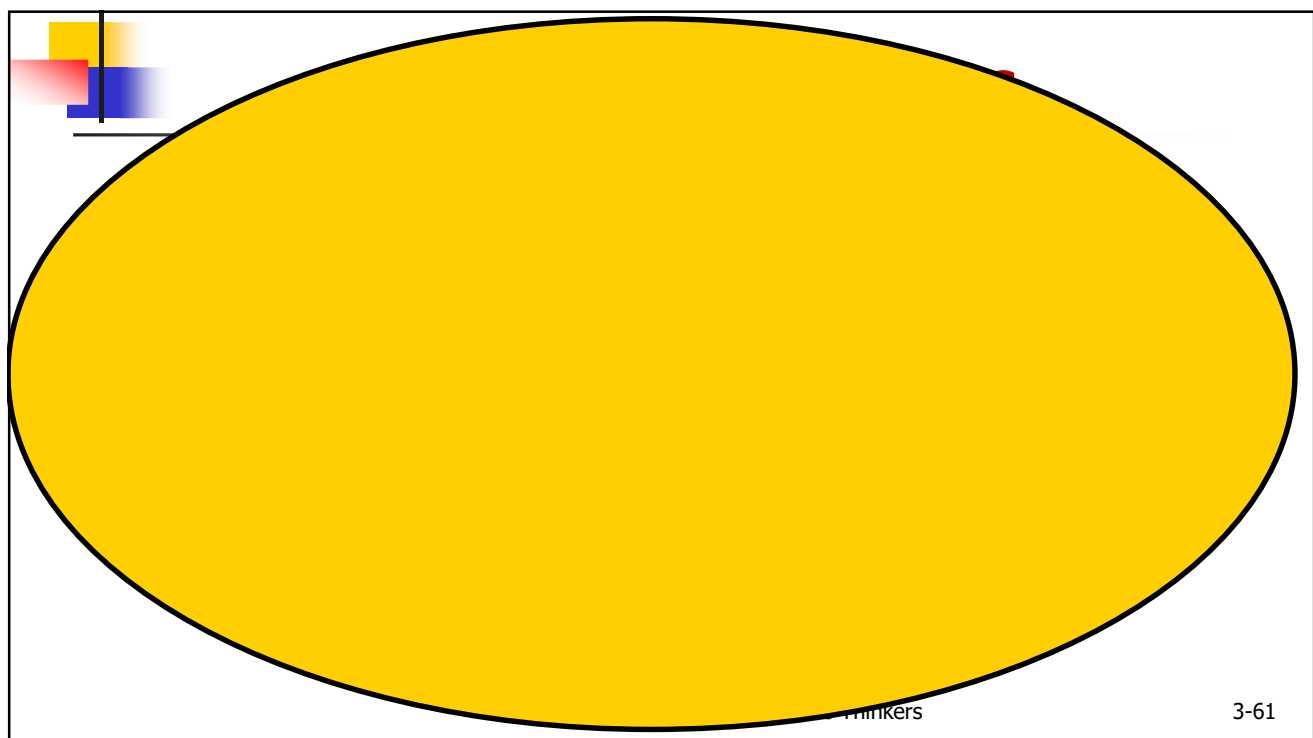
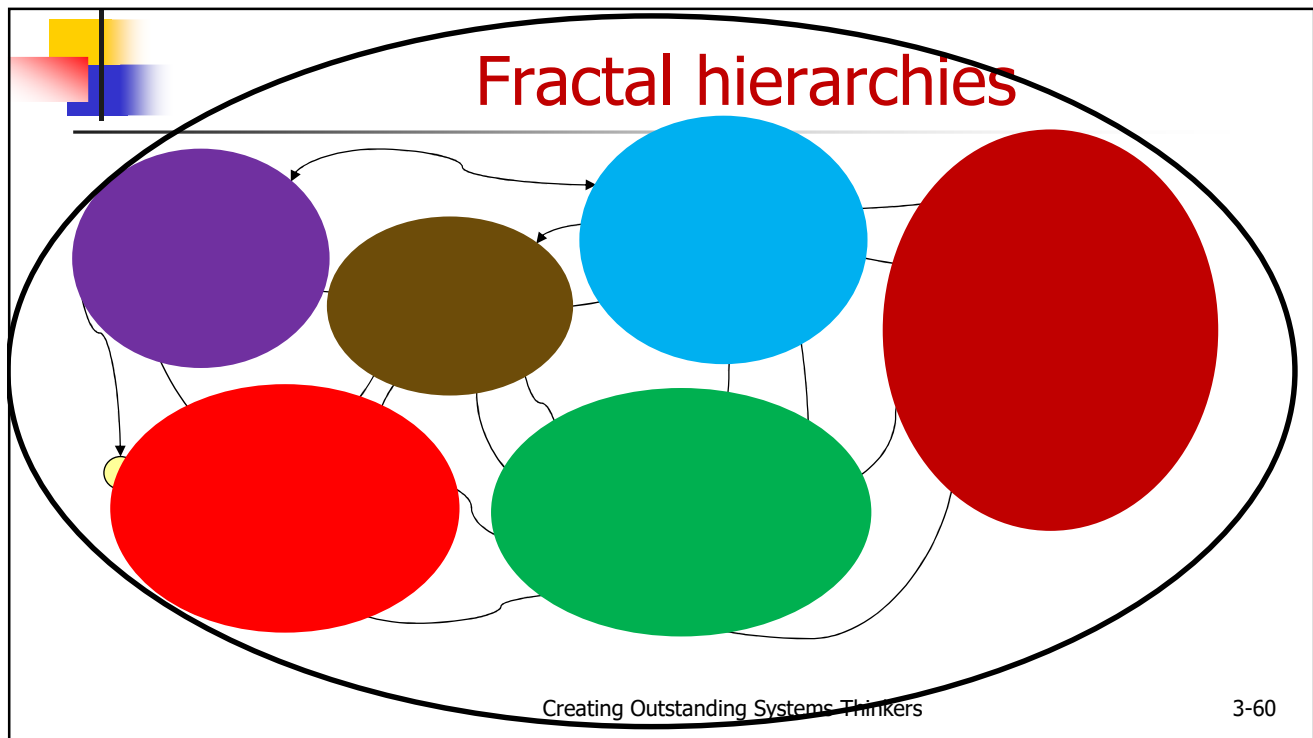
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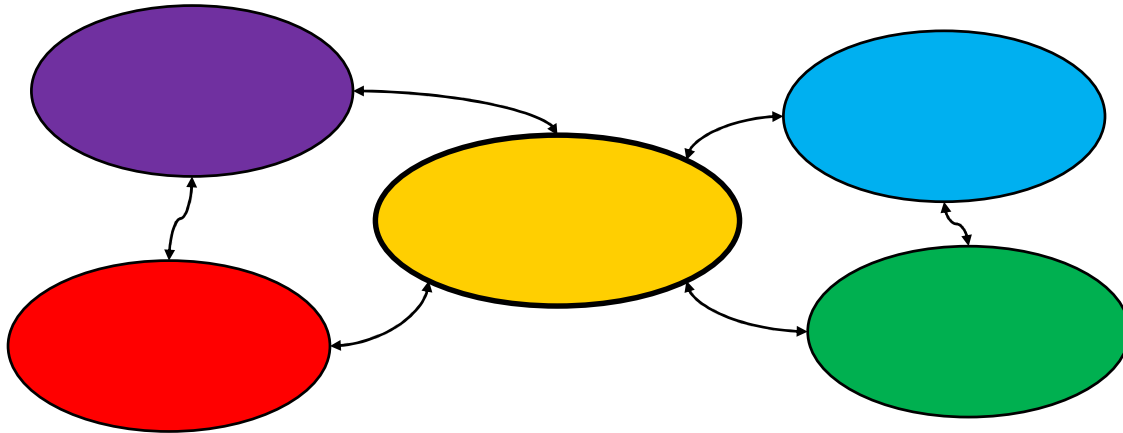








Fractal hierarchies



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Topics

- Emergence
- Hierarchies of systems
- **Storing information in the HTPs**
- Active brainstorming
- Exercises



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Documenting observations in the HTPs

- **Information about "Who ..."** belongs in the
 - **Operational:** if pertinent to who is performing in a scenario, vignette or use case
 - **Big Picture:** if pertinent to an adjacent system or systems
- **Information about "What ..."** belongs in the
 - **Big Picture:** if it is pertinent to the purpose of the system,
 - **Operational:** if pertinent to a scenario, vignette or use case
 - **Structural:** if pertinent to a physical element of the situation.
- **Information about "Where ..."** belongs in the
 - **Big Picture** Perspective
 - **Structural** perspective

Creating Outstanding Systems Thinkers

3-64

Documenting observations in the HTPs

- **Information about "When ..."** belongs in the
 - **Operational:** if pertinent to a scenario, vignette or use case
 - **Temporal:** if pertinent to the timeline in the story leading up to the situation
- **Information about "Why ..."** belongs in the
 - **Big Picture** Perspective
- **Information about "How ..."** belongs in the
 - **Functional** and **Structural:** (how it works)
 - **Operational:** (how it is used)
- Numeric information belongs in the **Quantitative** perspective.
- The cause, reason or problem is then inferred and stated as the **Scientific** perspective

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Royal Air Force (RAF) Battle of Britain Air Defence System (RAFBADS)

HT
6.4.3



Creating Outstanding Systems Thinkers 3-66



Topics

- Emergence
- Holistic thinking
- Storing information in the HTPs
- **Active brainstorming**
- Exercises



Creating Outstanding Systems Thinkers 3-67

Brainstorming

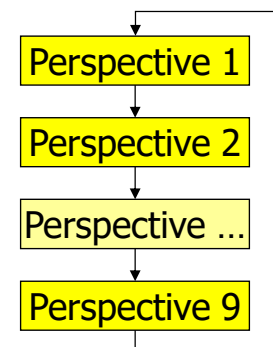
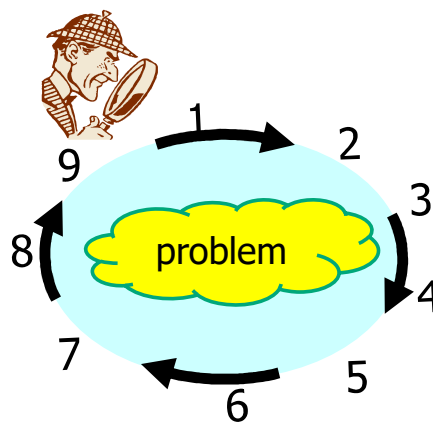
- Technique for ideation in small groups
 - Osborn A. F., Applied Imagination, 1963
- Rules
 - Think up ideas
 - No criticism of ideas
 - Go for large quantities of ideas
 - Build on each other's ideas
 - Encourage wild and exaggerated ideas

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3-68

Using the HTP's: Kipling questions

1. Who?
2. What?
3. Where?
4. When?
5. Why?
6. How?



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3-69

Active Brainstorming: HTP Matrix for triggering ideas

	1	2	3	4	5	6
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

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3-70

Typical *Operational* perspective questions*

- **Who** is going to operate/administrate it?
- **What** do they need to operate/administrate it?
- Under **what** conditions will it be operated?
- **Where** will they operate it?
- **When** will they operate it?
- **Why** will they operate it?
- **How** will they operate it?
- **How** will they gain access to it?

*HT Chapter 6.2.2

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Typical *Generic* perspective questions

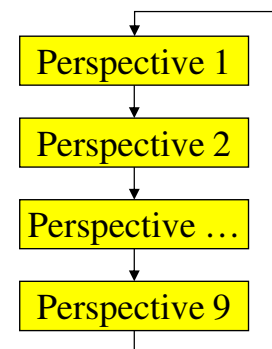
- **Who** has had a similar problem?
- **What** is this similar to?
- **What** does this remind you of?
- **What** applies to both situations?
- **Where** can I find a similar situation?
- **When** was there/will there be a similar situation?
- **Why** is this similar/different?
- **How** is this similar/different?

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Active Brainstorming

- Triggers ideas proactively
- Ideal for multidisciplinary teams
- Avoids single person capture effect in traditional brainstorming
 - Facilitator moves discussion across columns for each row
- HTP Matrix is an idea generating tool, ideas are **NOT** stored in the Matrix during active brainstorming



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Use Active Brainstorming **after** flow of initial set of ideas stops

- Don't interfere with initial free flow of ideas
- Don't force ideas into HTPs during initial thinking session
 - Do it later as appropriate
- Don't force ideas into HTPs during active brainstorming
 - Do it later as appropriate

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Exercise 3-21

- Review the ideas from Exercise 3-11
- Use Active Brainstorming to generate more ideas about the problem/solution
 - Focus on *Generic* and *Continuum* perspectives
 - Starter questions in Holistic Thinking Section 6.2.2 and updated in Systems Thinker's Toolbox Section 7.1
- Prepare <5 minute presentation on
 1. This slide
 2. The version number of the lesson
 3. **Which type of questions** generated the most ideas in your active brainstorming discussion
 4. A few of the actual questions
 5. Compare number of ideas from Brainstorming and Active Brainstorming
 6. Lessons learned from this session
 7. The compliance matrix
- Save as a PowerPoint file in format Exercise3-21-abcd.pptx
- Post in the asynchronous group as instructed

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Knowledge reading exercise 3-22

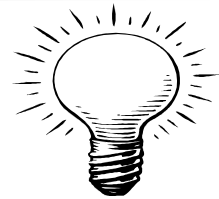
1. Prepare a brief on two main points in reading 0303 (< 5min)
2. Presentation to contain
 1. A summary of the content of the reading (<1 minute)
 2. The compliance matrix
 3. This slide and lesson version number
 4. A list of the main points
 5. The two briefings
 6. Reflections and comments on reading (<2 minute)
 7. Comparisons of content with other readings and external knowledge
 8. Why you think the reading was assigned to the module
 9. Lessons learned from module and source of learning e.g. readings, exercise, experience, etc. (<2 minutes)
3. Save as a PowerPoint file as Exercise3-32-abcd.pptx
4. Post/email presentation as, when and where instructed
5. Brief on one main point

Creating Outstanding Systems Thinkers

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Summary

- Emergence
- Holistic thinking
- Storing information in the HTPs
- **Active brainstorming**
- Exercises



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Any questions ?

1. Best
2. Worst
3. Missing



Separate email:

beyondsystemsthinking@yahoo.com

Subject: <class title> BWM Lesson #