



## Creating Outstanding Systems Thinkers

# Module 2: Critical Thinking

Rev 1.19.19

If you keep your mouth shut, people  
will only think you are stupid

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## Objectives

1. To introduce logic and reasoning
2. To introduce and practice critical thinking

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## Knowledge component

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- Lecture
- Readings
  - 0202 Holistic Thinking Chapter 5: Critical thinking
  - 0203 FUSE Chapter 10: Systems engineers are from Mars, software engineers are from Venus
- Exercises
  - 2-1 Applying a template for critical thinking
  - 2-2 Knowledge reading 0202
  - 2-3 Knowledge reading 0203

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## Topics

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- **Definitions**
- Critical thinking
- Exercises

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## Definitions

- Claim
  - Belief or opinion
- Argument
  - Present a reason for making a claim (prove or support)
- Explanation
  - Clarify, what it is made of, how it works, etc.
- Premise
  - Reasons for someone to accept a conclusion
- Conclusion
  - Outcome of thinking process
- Issues
  - Raised when claim is not accepted

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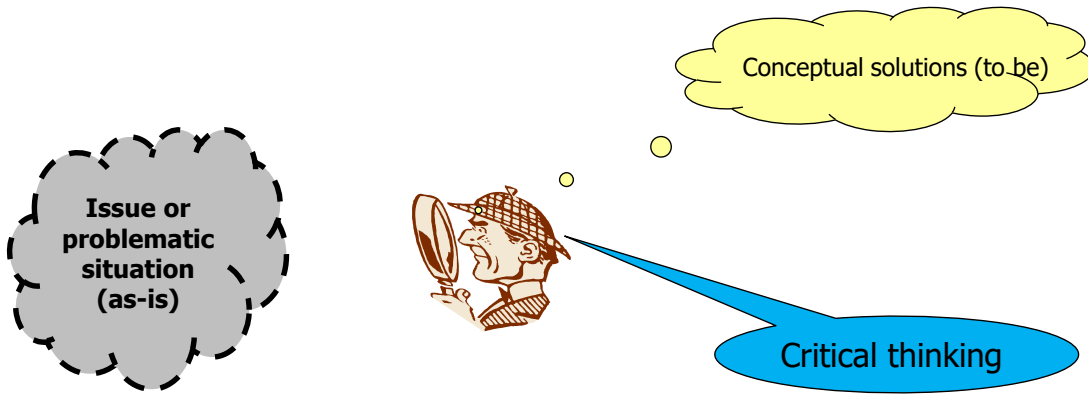
## Critical thinking

- From (using) “selection **criteria**” in decision-making, not **criticism**
- Logic and reasoning
  - Uses inductive and deductive logic
- Feasibility and reality of conclusions
  - Sanity check on ideas
- Judicious reasoning about what to believe and therefore what to do\*
  - \* Tittle, Peg, Critical Thinking: An appeal to reason, Routledge, 2011:4
- May also be known as smart thinking

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## Critical thinking and the HTPs



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## Logic

- Premise – can use
- Deductive logic
  - E.g. **IF** premise is true, **THEN** conclusion is true
- Inductive
  - Support by inference, not logic

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## Paradigm shift asking the right questions

<p><b>Non-systems thinking</b></p> <ul style="list-style-type: none"> <li>■ I live in Australia</li> <li>■ Adelaide is in Australia</li> <li>■ <b>I live in Adelaide T or F?</b> <ol style="list-style-type: none"> <li>1. True 100%</li> <li>2. False? 0%</li> </ol> </li> </ul>	<p><b>Systems thinking</b></p> <ul style="list-style-type: none"> <li>■ I live in Australia</li> <li>■ Adelaide is in Australia</li> <li>■ <b>Do I live in Adelaide?</b> <ol style="list-style-type: none"> <li>1. Yes 100%</li> <li>2. No 0%</li> <li>3. Perhaps &gt;0 % and &lt;100%</li> </ol> </li> </ul>
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The question frames the answer

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## The *Continuum* of answers

<p>■ Non-systems thinking</p> <ol style="list-style-type: none"> <li>1. Yes</li> <li>2. No</li> </ol> <p>■ Deterministic</p>	<p>■ Systems thinking</p> <ol style="list-style-type: none"> <li>1. Yes</li> <li>2. No</li> <li>3. It depends</li> <li>4. Don't know (unknown) or don't care                     <ul style="list-style-type: none"> <li>■ Dissolves Schrödinger's cat paradox</li> </ul> </li> </ol>
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No	Don't know				Yes
0% ..... Non-deterministic probability.....100%					
Strongly disagree	Disagree	Don't care	Agree	Strongly agree	

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## Topics

- Definitions
- **Critical thinking**
- Exercises



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## Elements of critical thought\*

- Cognitive strategies – micro skills
  - Comparing and contrasting ideal with actual practice
  - Thinking precisely about thinking: using critical vocabulary
  - Noting significant similarity and differences
  - Examining or evaluating assumptions
  - Distinguishing relevant from irrelevant facts
  - Making plausible inferences, predictions, or interpretations
  - Giving reasons and evaluating evidence and alleged facts
  - Recognizing contradictions
  - Exploring implications and consequences

\* Tittle P, 2011:4 citing Richard W. Paul, Developing Minds, revised edition volume 1, 1991:78

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## Elements of critical thought\*

- Cognitive strategies – macro skills-1
  - Refining generalizations and avoiding oversimplifications
  - Comparing analogous situations: transferring insights to new contexts
  - Developing one's perspective: creating or exploring beliefs, arguments, or theories
  - Clarifying issues, conclusions, or beliefs
  - Developing criteria for evaluation: clarifying values and standards
  - Evaluating the credibility of sources of information
  - Questioning deeply: raising and pursuing root or significant questions
  - Analyzing or evaluating arguments, interpretations, beliefs or theories

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## Elements of critical thought\*

- Cognitive strategies – macro skills-2
  - Generating or assessing solutions
  - Analyzing or evaluating actions or policies
  - Reading critically: clarifying or critiquing texts
  - Listening critically: the art of silent dialogue
  - Making interdisciplinary connections
  - Practicing Socratic discussion: clarifying and questioning beliefs, theories, or perspectives
  - Reasoning dialogically: comparing perspectives, interpretations, or theories
  - Reasoning dialectically: evaluating perspectives, interpretations, or theories

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## Logic of the absurd\*

- Thank God I am an atheist
- Newspaper headline
  - Body of man found in graveyard
- Signs in shops
  - Don't be cheated elsewhere, come in here
  - [Optician] if you can't see, you've come to the right place
  - [Beauty shop] ears pierced while you wait, pay for two, get one done free
- Advertisements
  - Passport for sale, never used. Owner going abroad
  - Visit our bargain basement on the third floor

\* Des MacHale, The Book of Irish Bull, Mercier Press, 1987.

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## Template for critical analysis of arguments-1\*

1. What's the point (claim/opinion/conclusion) of the argument?
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

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## 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

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## Quality of thinking

- Logic and reasoning
  - See inductive and deductive logic
- Feasibility and reality of conclusions
  - Sanity check on ideas

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## Critical thinking - Plastic bag tree?



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

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## Preventing flops-1

- Internet Refrigerator
  - LG, 2007
    - US\$8000 list price
    - Date book, photo album, electronic whiteboard, Web browser, music jukebox, video camera and TV
    - Food tracking program with manual entry of data



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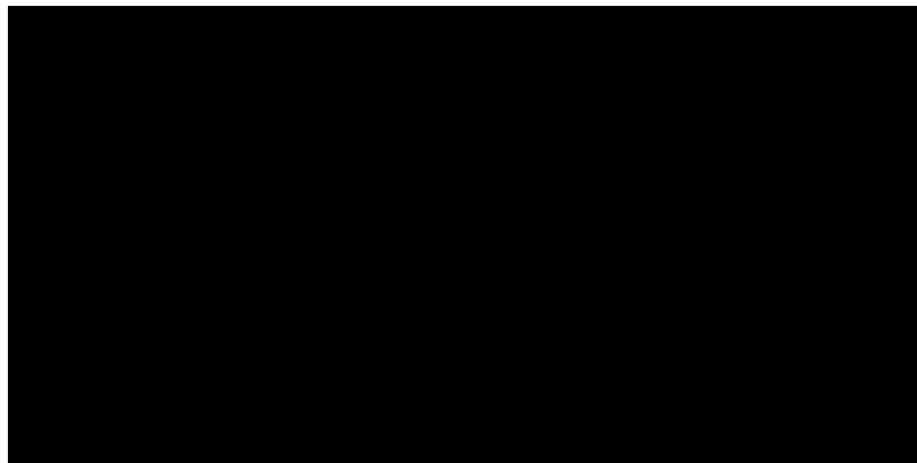
## Preventing flops-2

- **Idea creation**
  - Add RFID technology to **credit card**
- Operational thinking
  - Speeds up transactions
    - anticipated consequences
- Continuum/critical thinking
  - There are unanticipated consequences

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## RFID technology added to credit cards



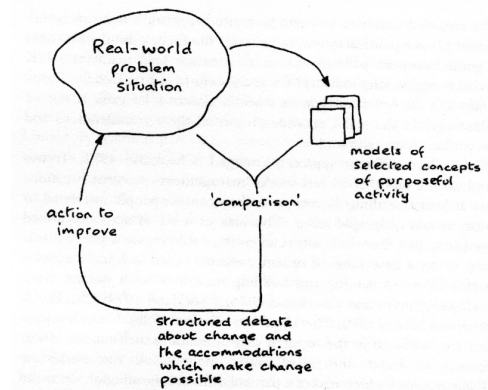
[http://www.youtube.com/watch?v=49o91DvqQ7k&feature=player\\_detailpage](http://www.youtube.com/watch?v=49o91DvqQ7k&feature=player_detailpage), accessed 16 March 2015

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## Process of creativity ?

1. Observe the undesirable situation
  2. Determine root cause
  3. Mentally create reference representations (**models**)
  4. Gap analysis
  5. Recommend changes to close the gap
- **Risk** – validity of reference models



SSM Checkland and Holwell, 1998

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## Topics

- Definitions
- Critical thinking
- **Exercises**



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## Exercise 2-1

- Apply the template for critical analysis of arguments (Slides 2-17 and 2-19) to **reading 0203**.
- Prepare <5 minute presentation which contains
  1. This slide and the version number of the lesson
  2. The questions in the template (a list)
    - i.e., the numbered question lines
  3. The application of the template to improve the reading
    - Your responses to each question about the reading
    - The result of your critical thinking about the questions about the reading
  4. The lessons learned in the session and in the exercise
  5. The compliance matrix
- Save as a PowerPoint file in format Exercise2-1-abcd.pptx
- Post/email presentation as instructed

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## Knowledge reading exercise 2-2

1. Prepare a brief on two main points in reading 0202 (< 5min)
2. Presentation to contain
  1. A summary of the content of the reading (<1 minute)
  2. The compliance matrix
  3. This slide and the version number of the lesson
  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 Exercise2-2-abcd.pptx
4. Post/email presentation as, when and where instructed
5. Brief on one main point

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## Knowledge reading exercise 2-3

1. Prepare a brief on two main points in reading 0203 (< 5min)
2. Presentation to contain
  1. A summary of the content of the reading (<1 minute)
  2. The compliance matrix
  3. This slide and the version number of the lesson
  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 Exercise2-3-abcd.pptx
4. Post/email presentation as, when and where instructed
5. Brief on one main point

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## Summary

- Definitions
- Critical thinking
- Exercises

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## Meeting the objectives

1. Explained logic and reasoning
2. Explained and practiced critical thinking.

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## Any questions ?

1. Best
2. Worst
3. Missing

Email: [beyondsystemsthinking@yahoo.com](mailto:beyondsystemsthinking@yahoo.com)  
Subject: <class title> BWM Lesson #



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