

1. How many animals of each species did Moses take upon the ark with him?

- A. 0**
- B. 1**
- C. 2**
- D. infinite**

Answer: A. 0

The story goes that NOAH was on the ark, not MOSES. Our minds internalize cultural narratives and assumptions. We hear bits of such narratives and “fill in” the rest, even when it is not there. Therefore, language often evokes “realities” in our minds that are not real or accurate.

**Count the “F’s” in the following:
“FINISHED FILES ARE THE RESULT OF
YEARS OF SCIENTIFIC STUDY COMBINED
WITH THE EXPERIENCE OF YEARS.”**

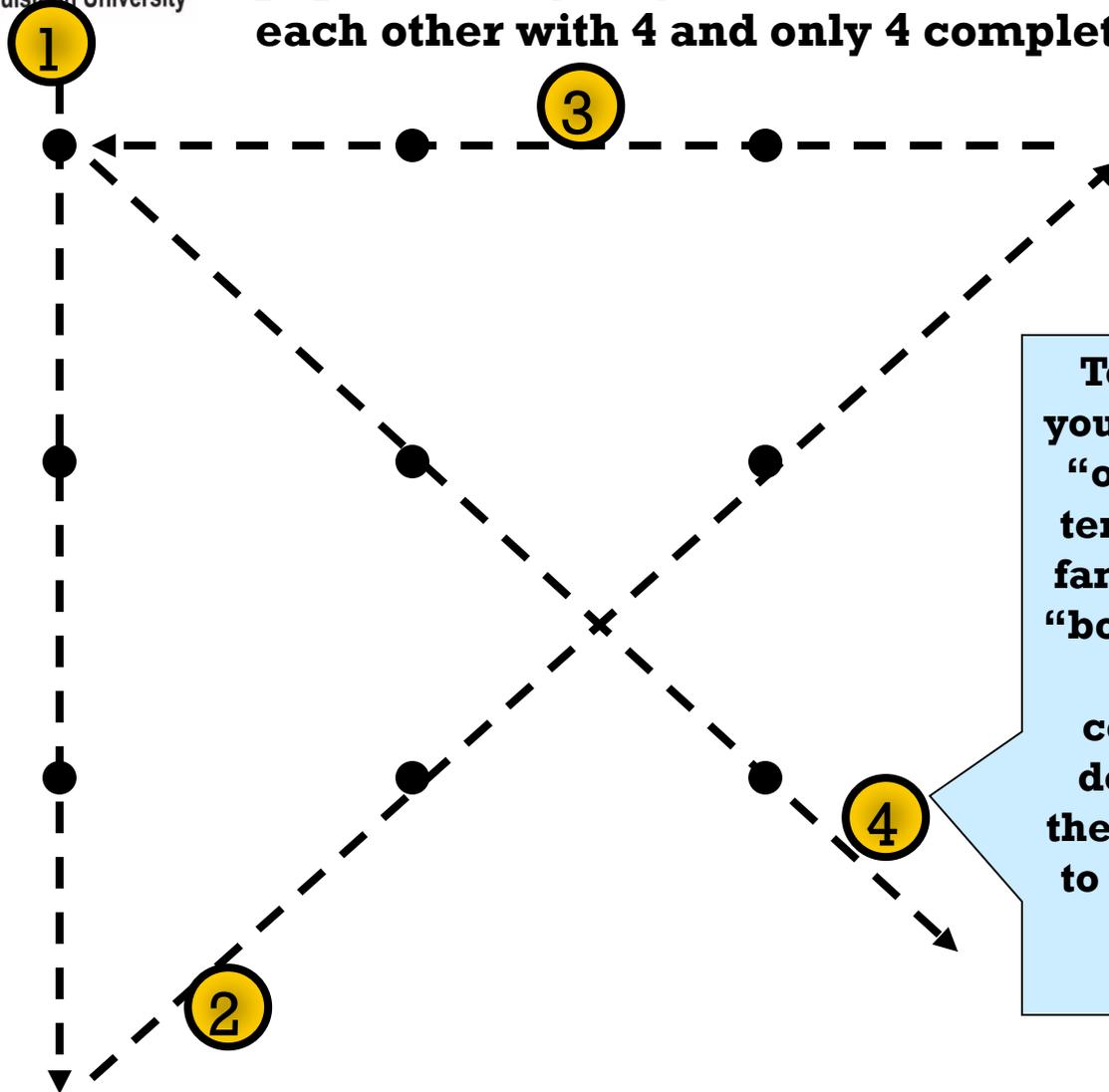
- A. 3**
- B. 4**
- C. 5**
- D. 6**

Answer: **D. 6**

**FINISHED FILES ARE THE RE-
SULT OF YEARS OF SCIENTIF-
IC STUDY COMBINED WITH
THE EXPERIENCE OF YEARS.**

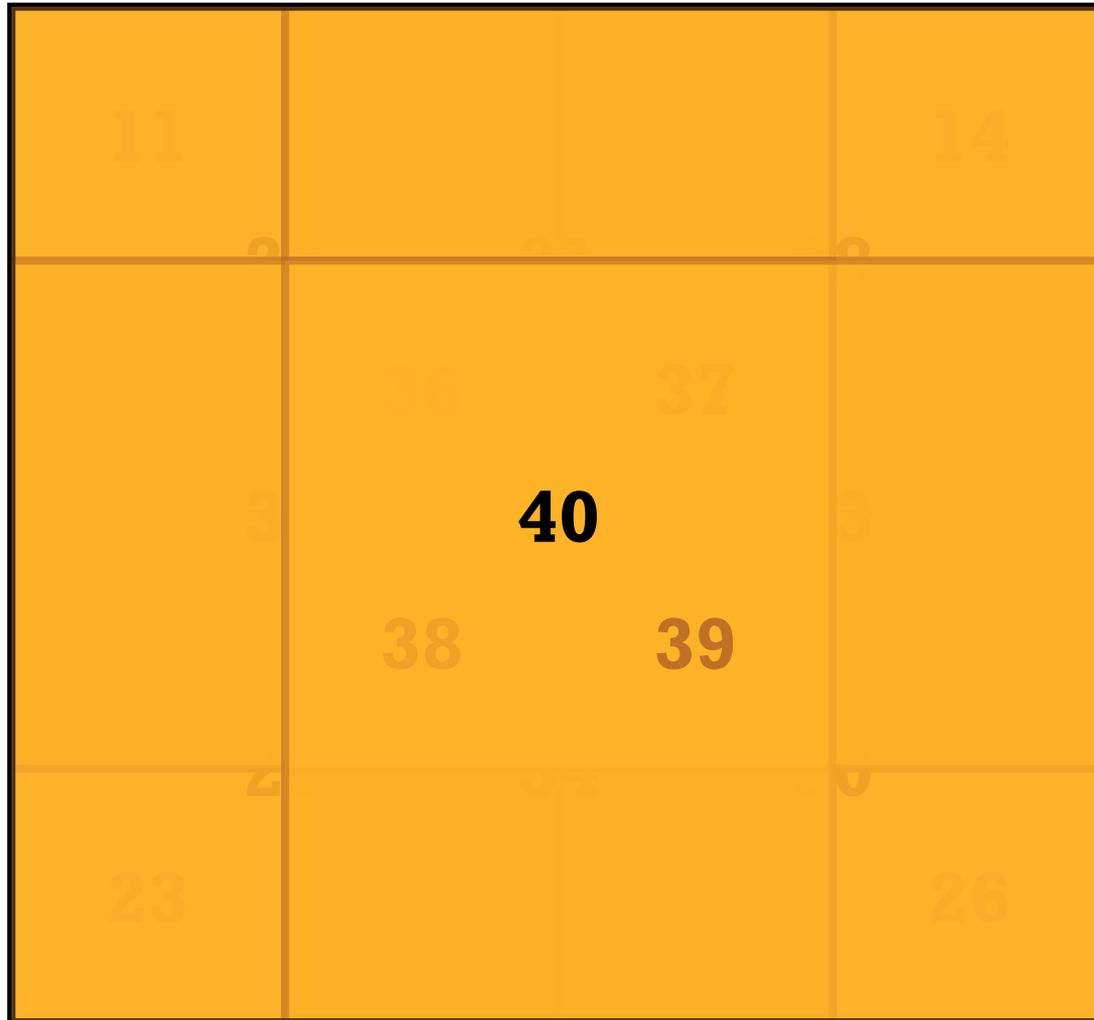
Because we often “speak” the words in our minds as we read them, we don’t “hear” the “F’s” because they don’t “sound” like “F’s”

The 9-dot problem: Draw 9 dots on a piece of paper exactly as you see here. Connect all 9 dots with each other with 4 and only 4 completely straight lines.



To solve this problem, you literally have to think “outside of the box.” We tend to think in terms of familiar objects, such as “boxes” or rooms, project the properties of a container onto these 9 dots, and then act as if there are “sides” or walls to the box that constrain our lines.

How many squares are in the figure below?



People often miss the correct answer on this problem due to lack of motivation to find all the boxes. Once a large number has been found, it often “seems good enough.”

Answer:

Young or Old?



You know when you meet people you have your initial impression. This impression can be completely faulty until you take the time to really understand and fully comprehend whom the person is that you are meeting. Going just by your initial impulse or initial judgment, does not give that person a chance to fully demonstrate to you, who that person is and what that person is really about.

Remember: looks can be deceiving.



Do you see the face? Or an Eskimo?

Can you see the forest or the trees?

When you're dealing with problems, often times you can get so caught up with the forest that you lose perspective of the trees involved. It is imperative that you are totally awakened to all aspects of the problem which you are facing.

Here is a picture of a natural setting. At the same time there are 11 human faces in the picture can you find them? If you are having problems finding them, then wake up to the fact that there are many aspects of problems you are solving which you are not picking up.

Critical thinking requires you to put a face to the problem and to identify all the faces of the problem involved. If you had no problem picking out the 11 faces, then you have succeeded in training your self to be more acute to your perceptions



What we can learn from these examples

- 1. Our senses are fallible—”seeing” should definitely NOT always be believing: With a ruler and calculator, you could solve some of these problems, but we tend not to scientifically “test” our everyday experiences with such care.**
- 2. Our common sense (i.e., inference) is fallible: For example, 9 dots look like squares we have encountered throughout our lives, and because most squares represent boundaries or walls, we infer that these 9 dots are “limits” in some sense to our lines.**

Cogito Ergo Sum

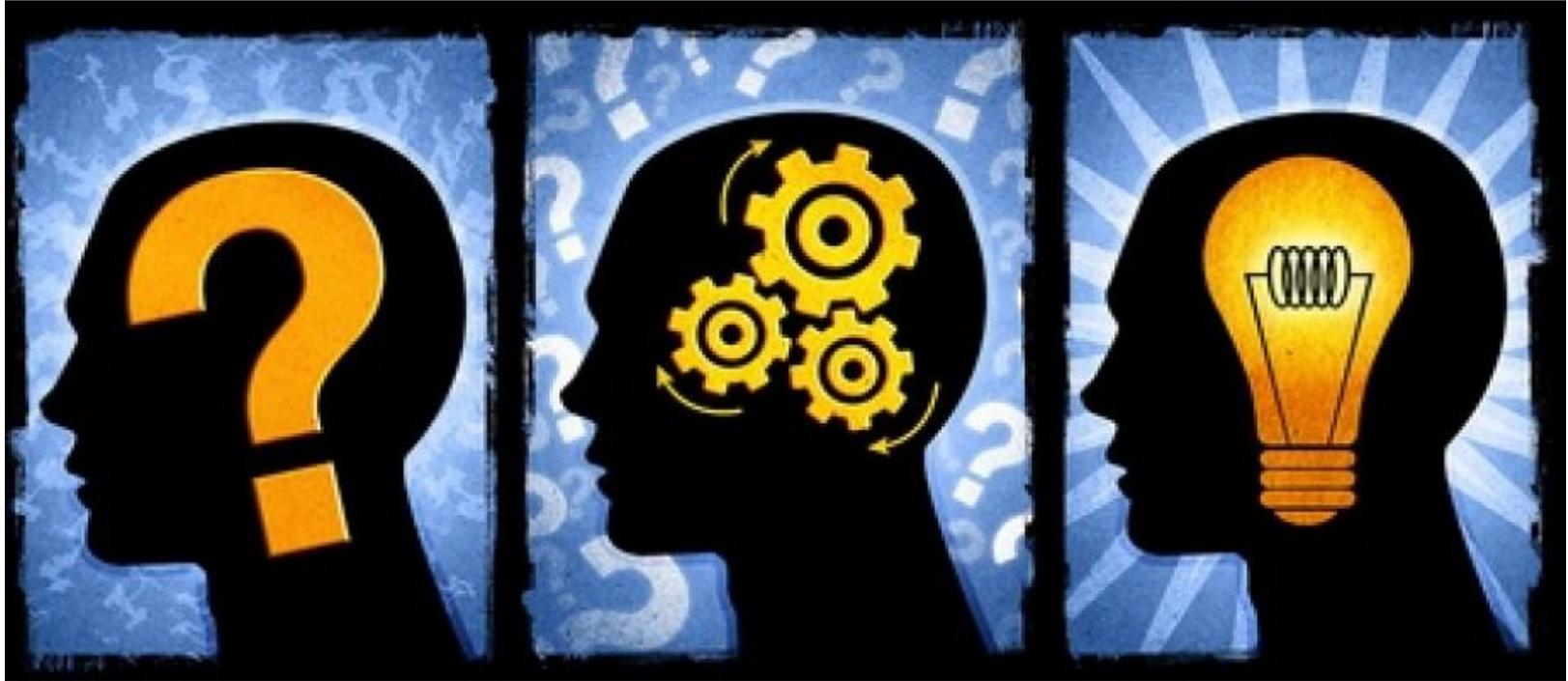
(Latin for “I think Therefore, I am” -- Renee Descartes)



Purpose of lesson:

- **Help you hone and improve your thinking skills by increasing your ability to efficiently and effectively solve “tame” and “wicked” problems.**

What is Critical Thinking (CT)?



Why is CT important to your agency's mission?

Critical Thinking Definition

The process of:

- examining underlying assumptions (*beliefs and perceptions*);
- interpreting and evaluating evidence (*context and values*);
- imagining and exploring alternatives (*different views and ideas*); &
- developing reflective criticism to reach a conclusion.



Critical Thinking versus Problem Solving

Critical Thinking

- **Critical thinking is a high level cognitive process that includes creativity, problem solving, and decision making.**
- **It is broader than problem solving and decision making and involves values, meaning, and personal relationships.**

Problem Solving

- **A problem is a gap between "what is" and "what should be".**



Critical Thinking in Our Contracting Business Mission Support Role

- **In our environment, being critical means:**
 - to be open-minded/flexible
 - thinking “outside the box”

- **But it also means:**
 - to be intellectually skeptical about ideas, claims, and arguments
 - not accepting things at face value



Critical thinking implies:

- **that there is a reason or purpose to the thinking, some problem to be solved or question to be answered.**
- **analysis, synthesis and evaluation of information**

Critical thinking is evaluating (judging) whether we should be convinced that some claim is true or some argument is good, as well as formulating good arguments.

Critical thinking recognizes:

- **Patterns and provides a way to use those patterns to solve a problem or answer a question**
- **Errors in logic, reasoning, or the thought process**
- **What is irrelevant or extraneous information**
- **Preconceptions, bias, values and the way that these affect our thinking.**
- **That these preconceptions and values mean that any inferences are within a certain context**
- **Ambiguity—that there may be more than one solution or more than one way to solve a problem**

**“It is human irrationality, not a lack of
knowledge that threatens human potential”
Nickerson 1986**



What are the Core Critical Thinking skills?

Interpretation

Analysis

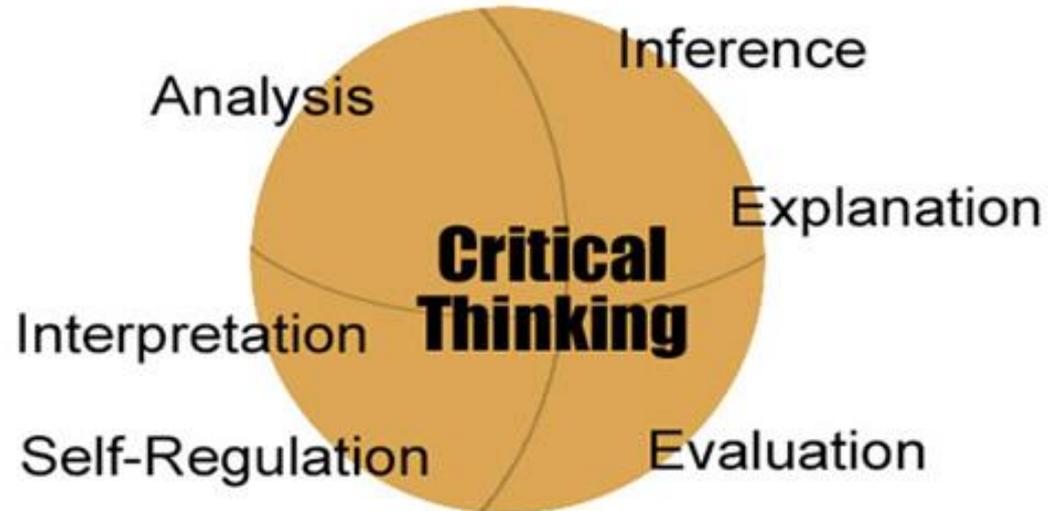
Evaluation

Inference

Explanation

Self-regulation

Core Critical Thinking Skills





WILEY
Kozzoo 1-20

1. Interpretation

Comprehending and expressing the meaning or significance of a wide variety of situations, data, events, etc.

Includes the skills of categorization and clarifying meaning

Examples include:

- **Recognizing a problem and describing it without bias**
- **Identifying an author's purpose, theme or point of view**

2. Analysis

Identifying the intended and actual inferential relationships among statements, questions and concepts intended to express belief, judgment, reasons, opinions, etc.

Includes examining ideas, detecting arguments, and analyzing arguments

Examples include:

- **Identifying the similarities and differences between different approaches to the solution of a problem**
- **Picking out the main claim in an article and tracing back the support of that claim**

3. Evaluation

Assessing the credibility of statements or representations which are accounts of a person's perception, opinion, or judgment; and to assess the logical strength of the actual or intended inferential relationships among these statements or representations

Examples include:

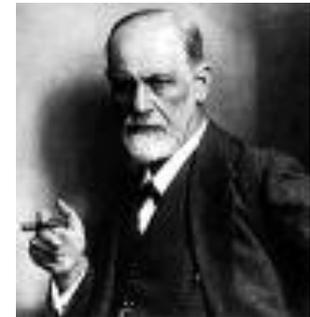
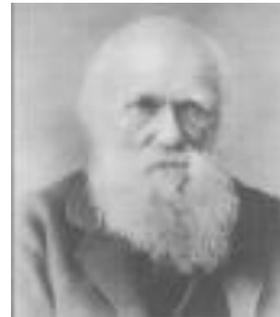
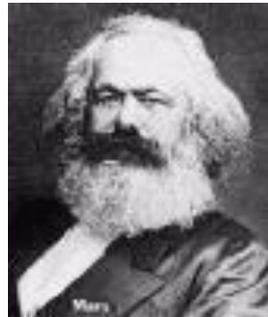
- **Judging an author's credibility**
- **Ascertaining if an argument's conclusion follows from its premises**

A good reasonable argument is ...

✓ factually correct	if and only if	all its premises are true
✓ valid	if and only if	its conclusion follow from its premises
✓ sound	if and only if	it is both factually correct and valid

Factually Correct?

- All the great thinkers have one thing in common. Look at Plato, Galileo, Marx, Darwin and Freud. What do you notice?



- They all have beards. Therefore their greatness must be attributable to this fact.

4. Inference

Identifying and securing the elements needed to draw reasonable conclusions; to consider relevant information and to determine the consequences from data, evidence, questions, etc..

Includes examining querying evidence, conjecturing alternatives and drawing conclusions

Examples include:

- **Developing a workable plan to gather information to resolve a given uncertainty**
- **Developing a set of options for addressing a problem you are facing**

5. Explanation

Presenting in a cogent and coherent way the results of one's reasoning

Includes describing methods and results, presenting full and well reasoned arguments in the context of seeking the best understanding possible

Examples include:

- **Constructing a chart which organizes one's findings**
- **Stating research results and describing the methods and criteria used to achieve those results**

6. Self-Regulation

Self-consciously monitoring one's cognitive activities, the elements used in those activities and the results, with a view toward questioning, confirming, validating or correcting one's reasoning or one's results

Includes self-examination and self-correction

Examples include:

- **Checking yourself when listening to a speaker in order to be sure you are understanding what is being said**
- **Examining your views on a controversial issue with sensitivity to possible influences of personal biases or self-interest**

Critical Thinking is about...

How you approach

- Problems
- Questions
- Issues

Experts conclude:

- **Critical Thinking is a pervasive, purposeful human phenomenon.**
- **Ideal critical thinker characterized also by how he or she *approaches life and living in general***

Critical Thinkers Ask Good Questions

- **Clarity**

- Could you elaborate further?
- Could you give me an example?
- Could you illustrate what you mean?

- **Accuracy**

- How could we check on that?
- How could we find out if that is true?
- How could we verify or test that?

- **Precision**

- Could you be more specific?
- Could you give me more details?
- Could you be more exact?

- **Relevance**

- How does that relate to the problem?
- How does that bear on the question?
- How does that help us with the issue?

- **Depth**

- What factors make this a difficult problem?
- What are the complexities of this question?
- What are the difficulties to deal with?

- **Breadth**

- Do we need to look at this from another perspective?
- Do we need to consider another point of view?
- Do we need to look at this in other ways?

- **Logic**

- Does all this make sense together?
- Does your first paragraph fit in with your last?
- Does what you say follow from the evidence?

- **Significance**

- Is this the most important problem to consider?
- Is this the central idea to focus on?
- What of these facts are most important?

- **Fairness**

- Do I have any vested interest in this issue?
- Am I taking into account the thinking of others?
- Have I examined by thinking for biases?

How do Critical Thinkers approach problems?

Clarity in stating question or concern

Orderliness in working with complexity

Diligence in seeking relevant information

Reasonableness in selecting & applying criteria

Care in focusing attention on the concern at hand

Persistence through difficulties

Precision to the degree permitted by subject & circumstances

Novice vs. Expert Thinker

Expert thinkers

- Quickly identify relevant information
- Can formulate a solution with “sketchy” information

Novice thinkers

- Consider all information equally important
- Develop hypothesis, test hypothesis
- Cannot focus on central issues



The Disposition Toward Critical Thinking

Systematic

Analytical

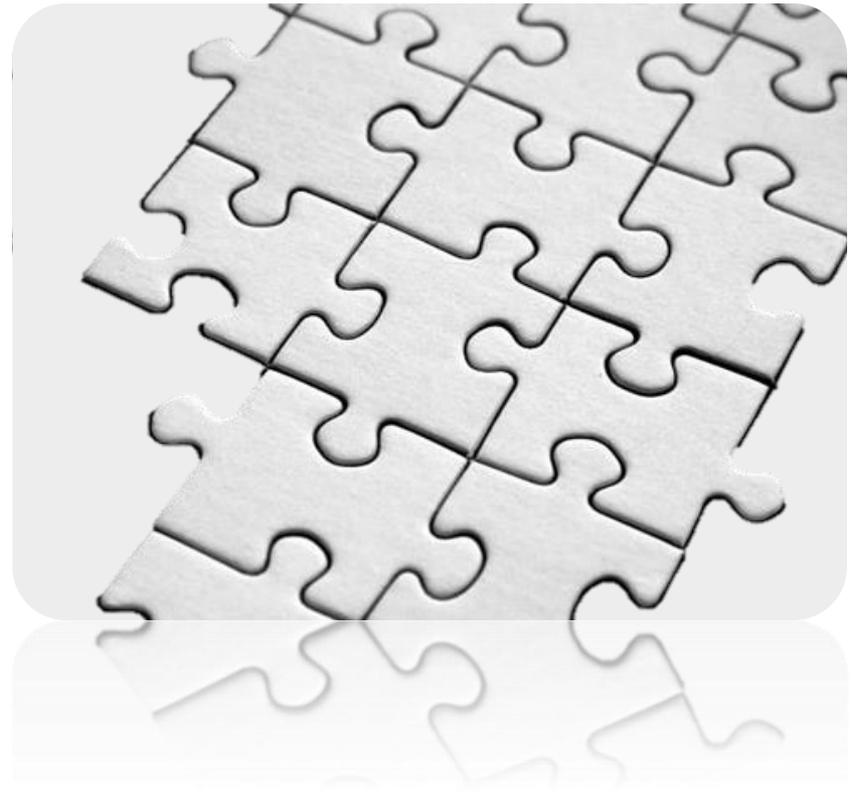
Open-minded

Inquisitive

Judicious

Truth Seeking

Confident in Reasoning





In the absence of CT...

- **We blindly reproduce the damaging reactions we have learned**
- **We blindly accept at face value all justifications given by organizations and political leaders**
- **We blindly believe TV commercials**
- **We blindly trust political commercials**
- **We blindly accept and say that if the textbook says it it must be so**
- **We blindly accept and say that if the organization does it it must be right**



Approaches to Good Critical Thinking Skills:

- **Inquisitiveness** about wide range of issues
- **Concern to become and stay well-informed**
- **Alertness to opportunities to use Critical Thinking**
- **Self confidence in one's abilities to reason**
- **Open-mindedness** about divergent world views
- **Flexibility** in considering alternatives & opinions
- **Understanding the opinions of other people**
- **Fair-mindedness** in appraising reasoning
- **Honesty in facing one's own biases, prejudices, stereotypes, egocentric, and sociocentric tendencies**
- **Prudence in suspending, making, altering judgments**
- **Willingness to reconsider** and revise views
- **Clarity** in stating question or concern
- **Orderliness in working with complexity**
- **Diligence** in seeking relevant information
- **Reasonableness** in selecting & applying criteria
- **Care in focusing attention** on the concern at hand
- **Persistence through difficulties**
- **Precision to the degree permitted** by subject & circumstances

Critical vs. Creative Thinking

Critical Thinking

Creative Thinking

analytic

generative

convergent

divergent

vertical

lateral

probability

possibility

judgment

suspended judgment

focused

diffuse

objective

subjective

the answer

an answer

left brain

right brain

verbal

visual

linear

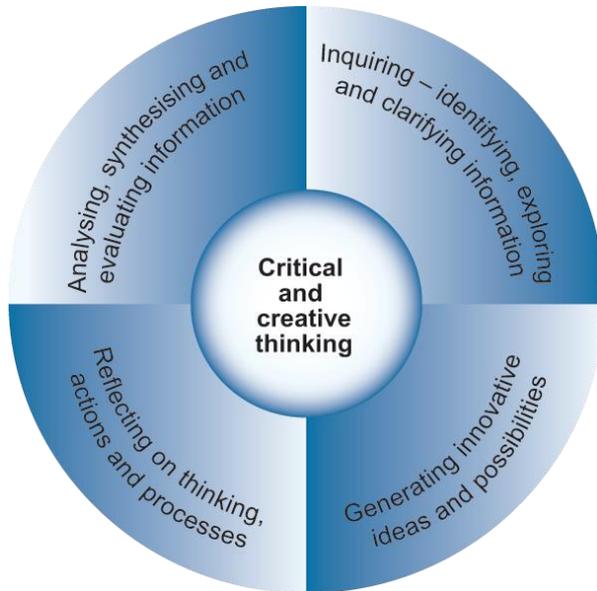
associative

reasoning

richness, novelty

Yes, but

Yes, and





Critical vs. Creative Thinking

<i>Critical Thinking</i>	<i>Creative Thinking</i>
analytic	generative
convergent	divergent
vertical	lateral
probability	possibility
judgment	suspended judgment
focused	diffuse
objective	subjective
answer	an answer
left brain	right brain
verbal	visual
linear	associative
reasoning	richness, novelty
Yes, but	Yes, and

CON 360 Holistic Critical Thinking Scoring Rubric

What kind of thinker are you?

- | |
|--|
| <p>4 Consistently does all or almost does all of the following:</p> <ul style="list-style-type: none">• Accurately interprets evidence, statements, graphics, questions, etc.• Identifies the salient arguments (reasons and claims) pro and con.• Thoughtfully analyzes and evaluates major alternative points of view.• Draws warranted, judicious, non-fallacious conclusions.• Justifies key results and procedures, explains assumptions and reasons.• Fair-mindedly follows where evidence and reasons lead. |
| <p>3 Does most or many of the following:</p> <ul style="list-style-type: none">• Accurately interprets evidence, statements, graphics, questions, etc.• Identifies the relevant argument (reasons and claims) pro and con.• Offers analyzes and evaluates obvious alternative points of view.• Draws warranted, non-fallacious conclusions.• Justifies some results or procedures, explains assumptions and reasons.• Fair-mindedly follows where evidence and reasons lead. |
| <p>2 Does most or many of the following:</p> <ul style="list-style-type: none">• Misinterprets evidence, statements, graphics, questions, etc.• Fails to identify the relevant argument (reasons and claims) pro and con.• Ignores or superficially evaluates obvious alternative points of view.• Draws unwarranted or fallacious conclusions.• Justifies few results or procedures, seldom explains assumptions and reasons.• Regardless of the evidence or reasons, maintains or defends views based on self-interest or preconceptions. |
| <p>1 Consistently does all or almost all of the following:</p> <ul style="list-style-type: none">• Offers biased interpretations of evidence, statements, graphics, questions, information, or the points of view of others.• Fails to identify or hastily dismisses strong, relevant, counter arguments.• Argues using fallacious or irrelevant reasons and unwarranted claims.• Does not justify results or procedures, nor explain reasons.• Regardless of the evidence or reasons, maintains or defends views based on self-interest or preconceptions.• Exhibits close mindedness or hostility to reason. |



Critical Thinking Tools

If... Then

Fishbone

Affinity Diagram

Five Whys

Force Field Analysis

Summary... Critical thinkers can:

Approach something new in a logical manner

Take their critical thinking skills and apply them to everyday life

Support their opinions with evidence, data, logical reasoning, and statistical measures

Look at a problem from multiple angles