Knowledge, Intelligence, Thinking & Creativity

1

Knowledge and intelligence

- The information that gets absorbed in individual's brain is called knowledge.
- An individual's ability to absorb information and use it to solve problems is called intelligence
- Intelligence and knowledge have a critical role to play in individual's creativity. HOW?
- Creativity is dependent on an individual's knowledge and how he or she combines his or her knowledge to create new perspectives.

Read the following paragraph

- rscheearch
- litteers
- iprmoetnt
- preecsievs
- tuhoght

Read the following paragraph

- **"Aoccdrnig to rscheearch at Maerekre Uinvervtisy, it deosn't mttaer in waht oredr the litteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a ttoal mses and you can sitll raed it wouthit a porbelm. Tihs is besauae ocne we laren how to raed we bgien to aargnre the lteerts in our mnid to see waht we epxcet to see. The huamn mnid deos not raed ervey lteter by istlef, but preecsievs the wrod as a wlohe. We do tihs ucnsoniuscoly wuithot tuhoght."**

Explicit & Tacit Knowledge

- Formal knowledge transmitted through education undergoes profound changes and becomes transformed to informal or tacit knowledge.
- Through using metaphors and analogies, various personal hunches and insights may be explicated and further elaborated and new ideas and innovations created.

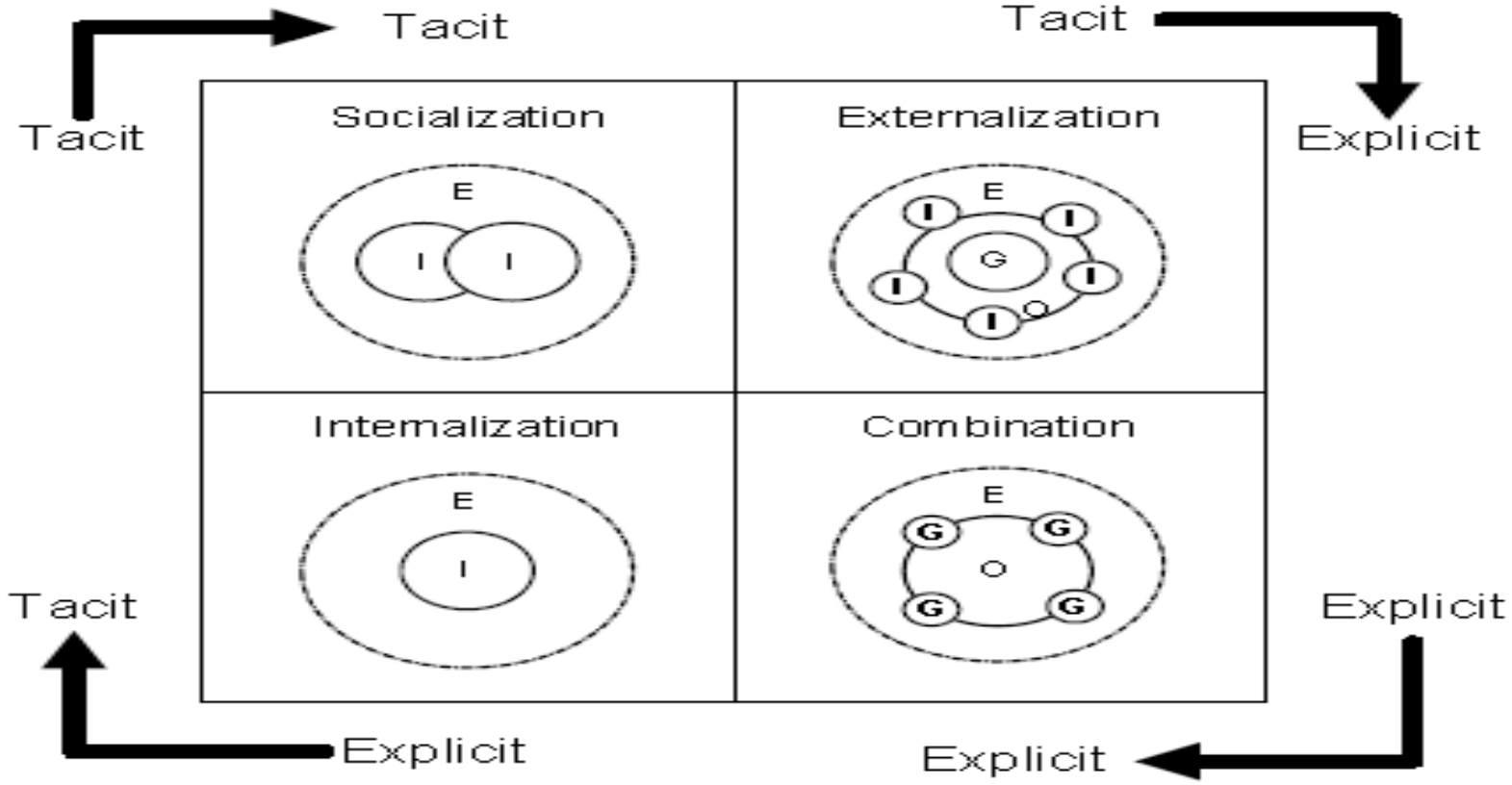


Figure 2: Theory of Knowledge Creation by Nonaka and Toyama (2003)

Read aloud the following colors as fast as you can:

Read aloud the colours of the following words

red	green
blue	orange
black	blue
yellow	gray
red	pink

What do you see?

Expertise

- A well-organized body of accessible and useful domain-specific knowledge.
- Allows identification of promising solutions among an infinite number of other alternatives.

Creativity presupposes expertise:

- conceptual spaces cannot be effectively explored without knowing one's way around them!

Types of expertise

Routine expertise

- Quick and accurate solving of familiar problems
- Little capacity of dealing with novel types of problems

Adaptive expertise

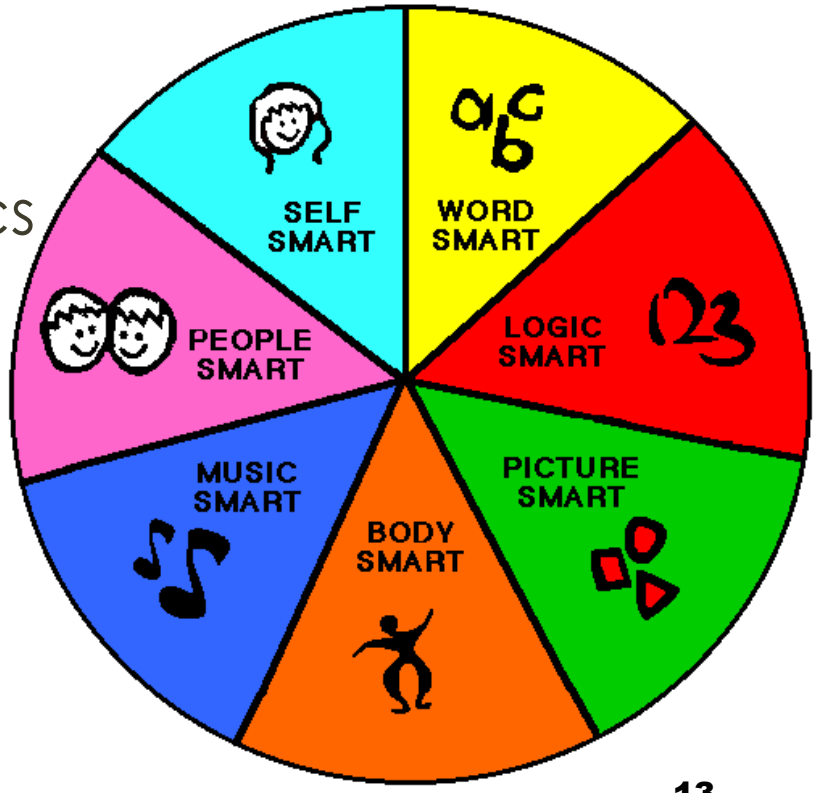
- Effective solving of new problems
- Generation of new procedures and practices from expert knowledge
- Deep conceptual understanding

Crystallized & fluid competence

- **Crystallized competence** represents partially automated patterns of problem solving developed in practical experience.
- **Fluid competence** refers to processes of deriving knowledge and skills needed for solving new problems from the expert's knowledge base.
- Need to balance Crystallized and fluid competence

Multiple Intelligence

- Howard Gardner
- 7 types of intelligences
  - linguistic
  - musical
  - logical-mathematics
  - spatial
  - bodily-kinesthetic
  - intrapersonal
  - interpersonal



Nature Smart
(Naturalist)

People Smart
(Interpersonal)

Number Smart
(Logical/Mathematical)

Picture Smart
(Spatial/Visual)

Self Smart
(Intrapersonal)

Body Smart
(Bodily-Kinesthetic)

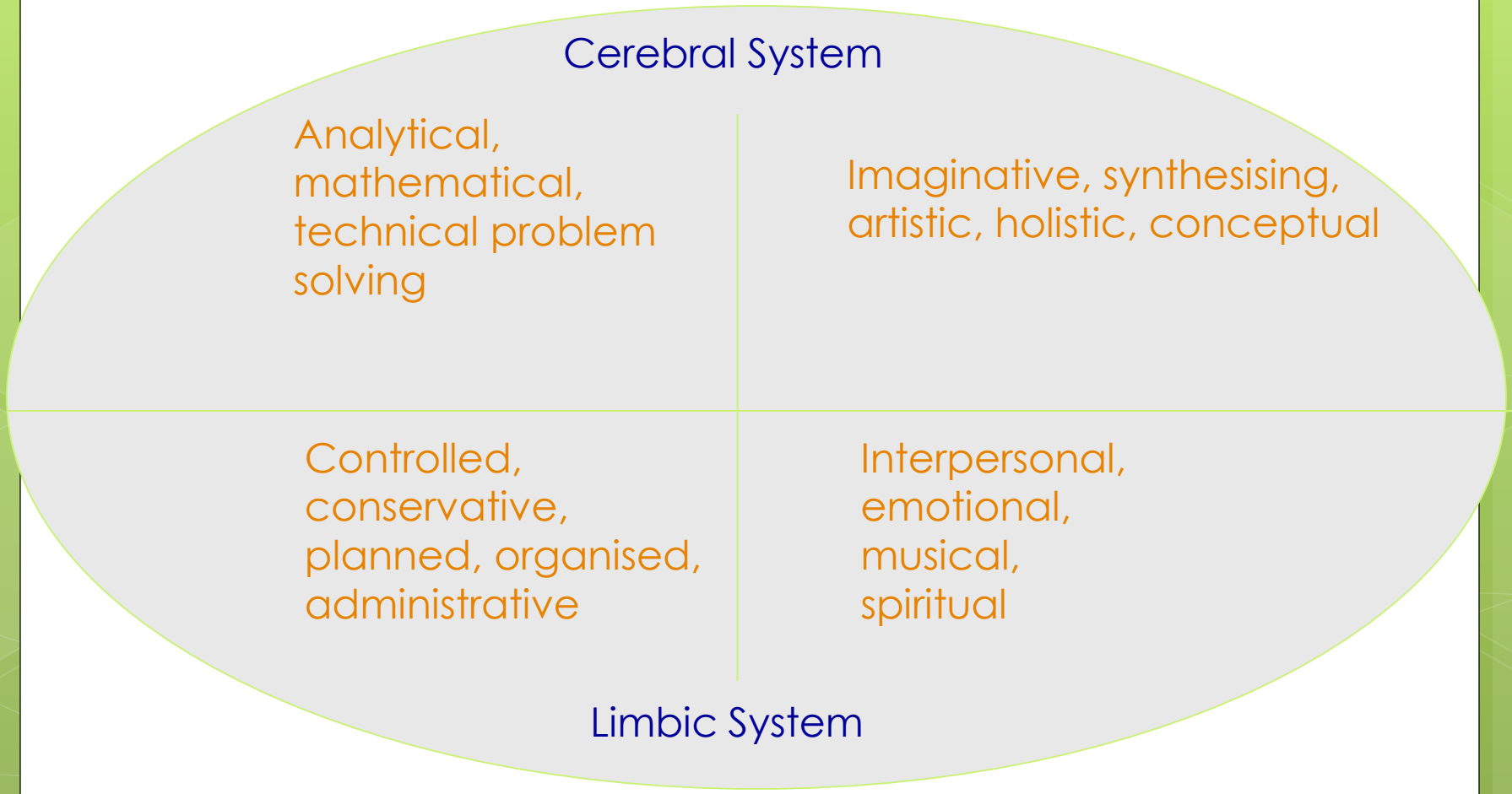
Music Smart
(Musical)

Word Smart
(Linguistic)

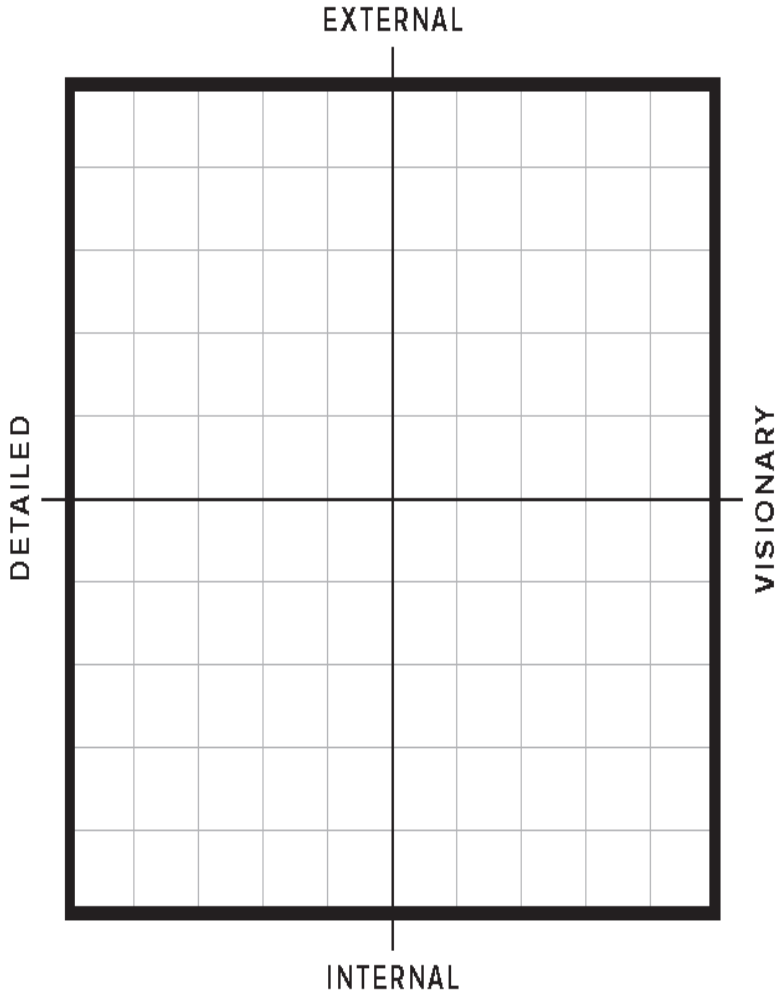
Left Brain	Right Brain
40%	60%
Left Brain	
37%	Linear
20%	Reality-based
17%	Symbolic
14%	Verbal
13%	Logical
9%	Sequential
Right Brain	
39%	Random
29%	Intuitive
28%	Concrete
25%	Nonverbal
24%	Holistic
16%	Fantasy-oriented

Left Brain	Right Brain
59%	41%
Left Brain	
42%	Symbolic
40%	Verbal
38%	Logical
35%	Sequential
32%	Linear
27%	Reality-based
Right Brain	
48%	Fantasy-oriented
29%	Intuitive
28%	Concrete
17%	Random
13%	Nonverbal
6%	Holistic

WHOLE BRAIN MODEL



Thinking Styles



Creation of Ideas

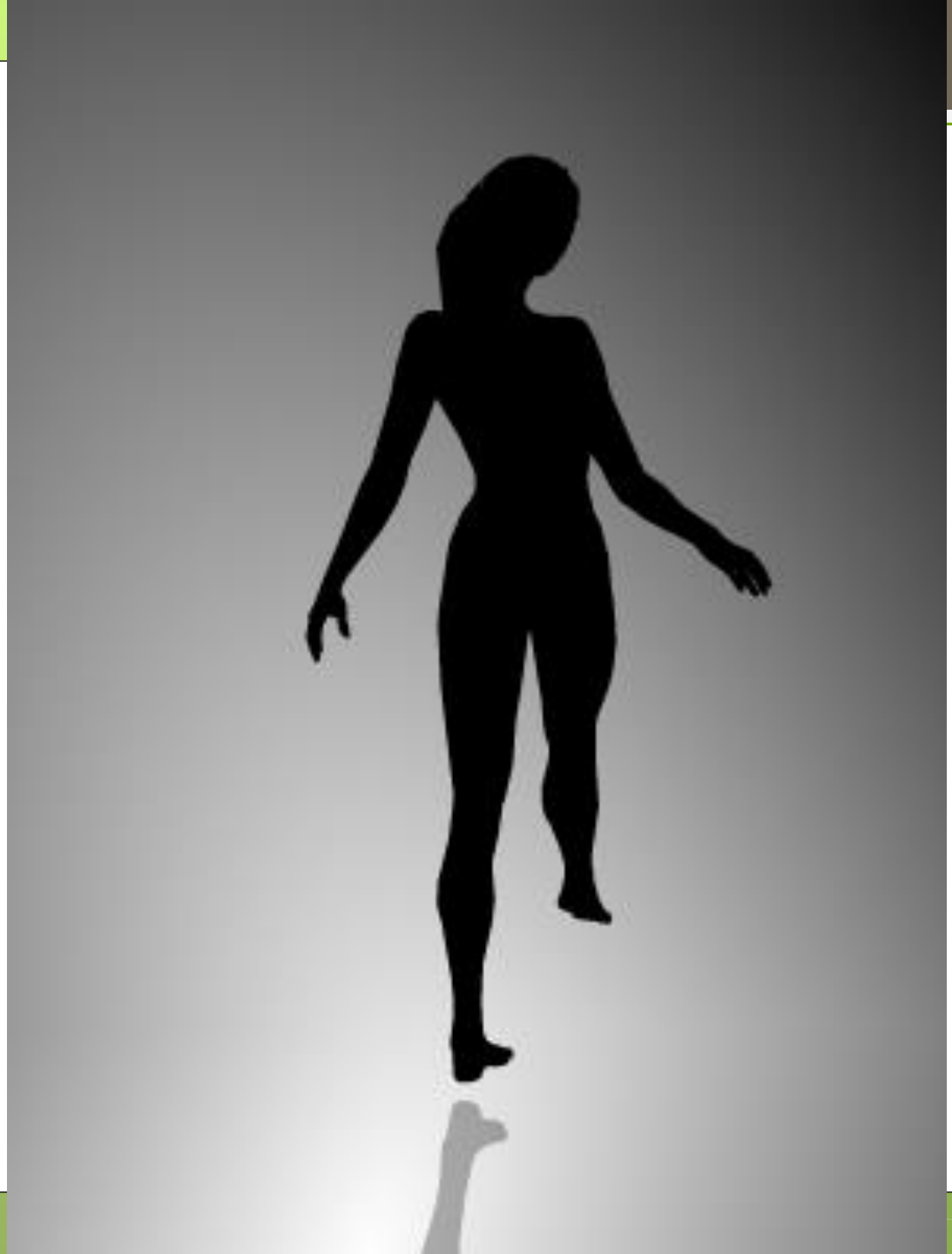
Internal thinkers express themselves through writing & take longer to develop & express ideas

External thinkers express themselves through speech & are faster at developing & expressing ideas

Application of Ideas

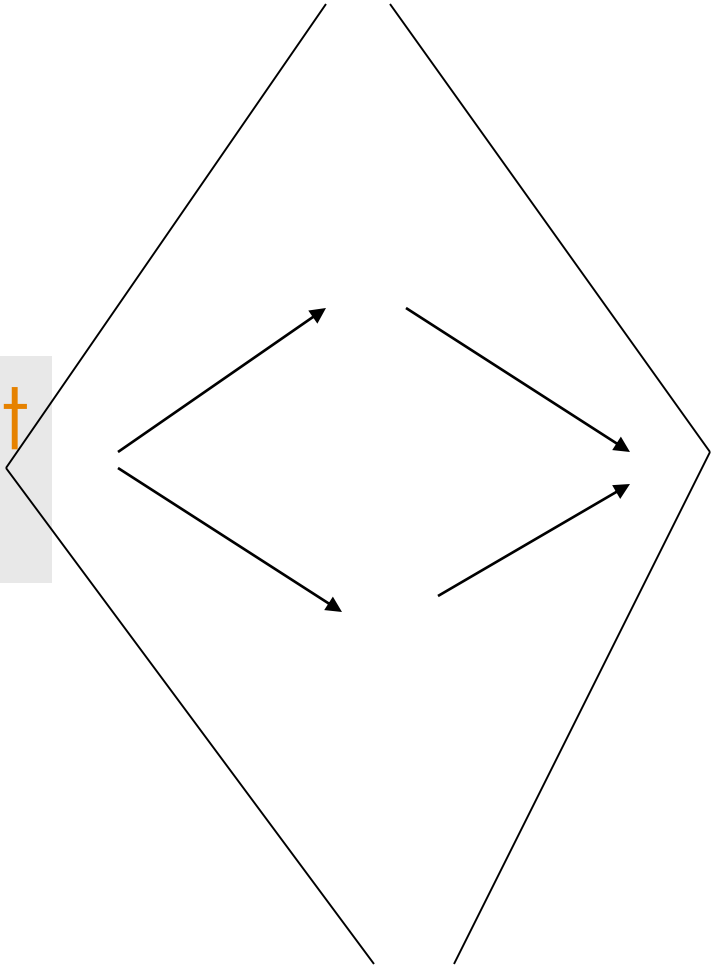
Detailed thinkers focus on specific, existing situations. Start small & work towards conquering the greater whole

Visionary thinkers focus on broad, potential situations. Start big & work towards solving the more specific parts of a given problem



DIVERGENT AND CONVERGENT THINKING

Divergent Thinking



Convergent Thinking

Thinking Styles

- Too much emphasis is put on teaching students to **think critically**
- **Critical thinking is about** how to understand claims, follow or create a logical argument, figure out the answer, eliminate the incorrect paths and focus on the correct one.
- **Creative thinking** focuses on exploring ideas, generating possibilities, looking for many right answers rather than just one,.
- **Creative thinking** is generally considered to be involved with the creation or generation of ideas, processes, experiences or objects; **critical thinking** is concerned with their evaluation.

Types of Problematic Thinking

- **Filtering:** magnifying negatives while filtering out all positives
- **Polarized Thinking:** no middle ground
- **Overgeneralization:**
- **Mind Reading:**
- **Catastrophizing:** Always expecting disaster.
- **Personalization:** Thinking that everything people do or say is some kind of reaction to you.
- **Control Fallacies:** Feeling externally controlled, helpless, and a victim of fate.
- **Fallacy of Fairness:** Assuming knowledge of what's fair but others won't agree with you.
- **Blaming** Yourself or others for *your* pain. without regard to external causes.
- **Shoulds:** a list of "rules" about how you and other people should act.
- **Emotional Reasoning: B**elieving that feelings must be true- automatically.
- **Fallacy of Change:** Expecting others to change to suit you.
- **Global Labelling:** Generalizing incidents into negative global judgment.
- **Being Right:** Always trying to prove that your opinions and actions are correct.
- **Heaven's Reward Fallacy:** Expecting sacrifices & self-denials to pay off, and feeling bitter if they don't .

Critical Thinking	Creative Thinking
Analyses existing ideas	Generates new ideas
Converges on probable solutions	Diverges to new possibilities
Vertical	Lateral
Probability is most emphasized	Possibilities are most emphasized
Judgment	Suspended judgment
Focused on the probable solutions	Diffuse – multiples possibilities
Objective – not influenced by an individual's personal feelings	Subjective – depends on the individuals' views or tastes.
Verbal – can be expressed in words	Visual – can only be visualised
Linear	Associative
Reasoning	Richness, novelty
Yes but	Yes and

CONDITIONS OF CREATIVE THINKING

- Receptivity
- Immersion
- Seeing questions
- Utilisation of errors
- Detached devotion

Some Creative thinking Techniques

- ***Brainstorming***
- **The Questioning Technique**
- **Assumption Smashing:**
- **Attribute Analysis.**
- **Morphological Analysis.**
- **Manipulative Verbs.**
- **Problem Reversal.**
- **Forced Analogy.**
- **Metaphorical thinking.**
- **Trigger Concepts.**

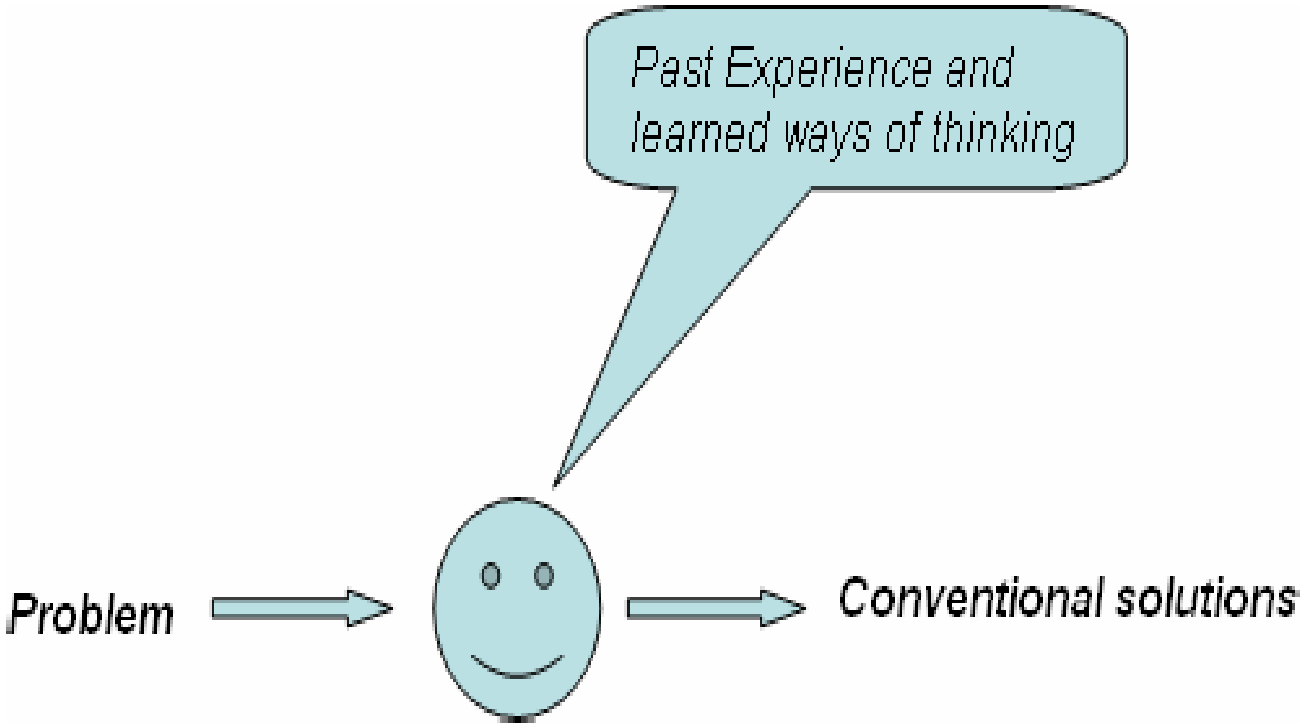
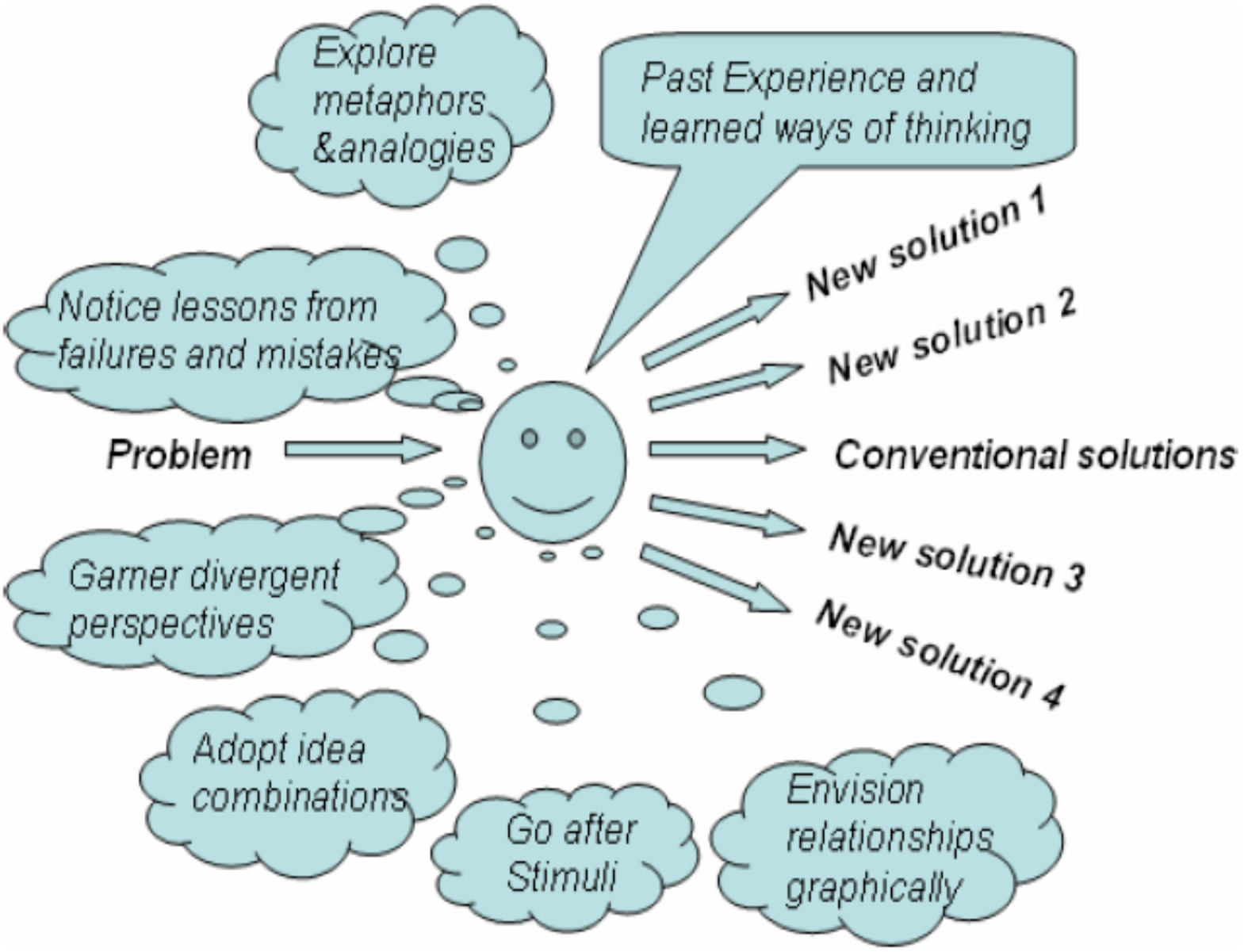
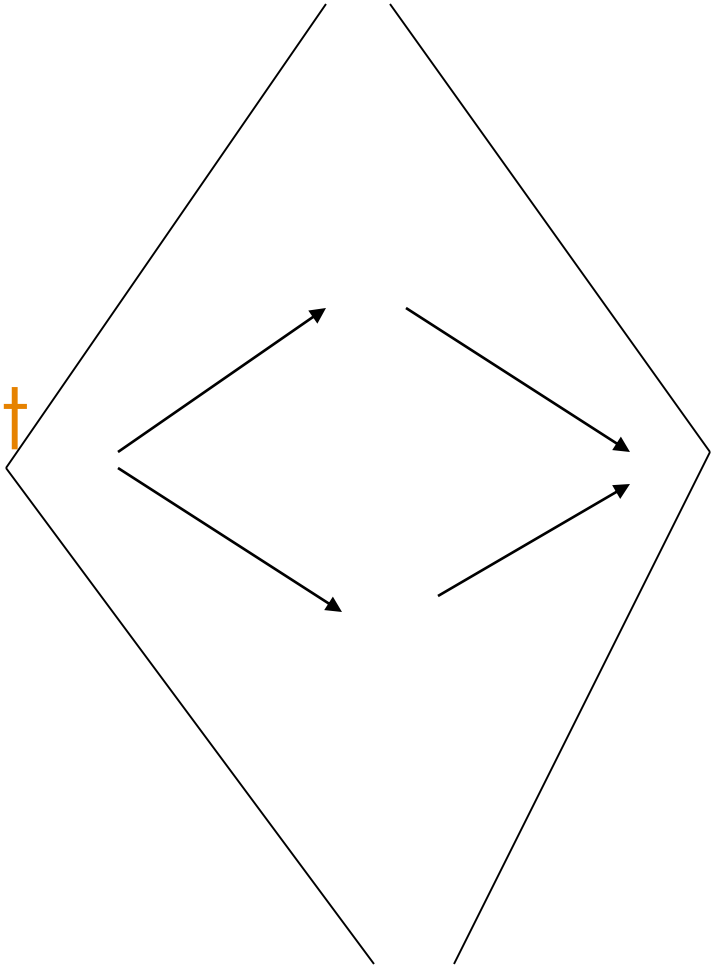


Fig. 6. Conventional thinking patterns.


Explore metaphors &analogies
Past Experience and learned ways of thinking
Notice lessons from failures and mistakes
New solution 1
New solution 2
Problem
Conventional solutions
New solution 3
Garner divergent perspectives
New solution 4
Adopt idea combinations
Go after Stimuli
Envision relationships graphically

DIVERGENT AND CONVERGENT THINKING

Divergent Thinking



Convergent Thinking

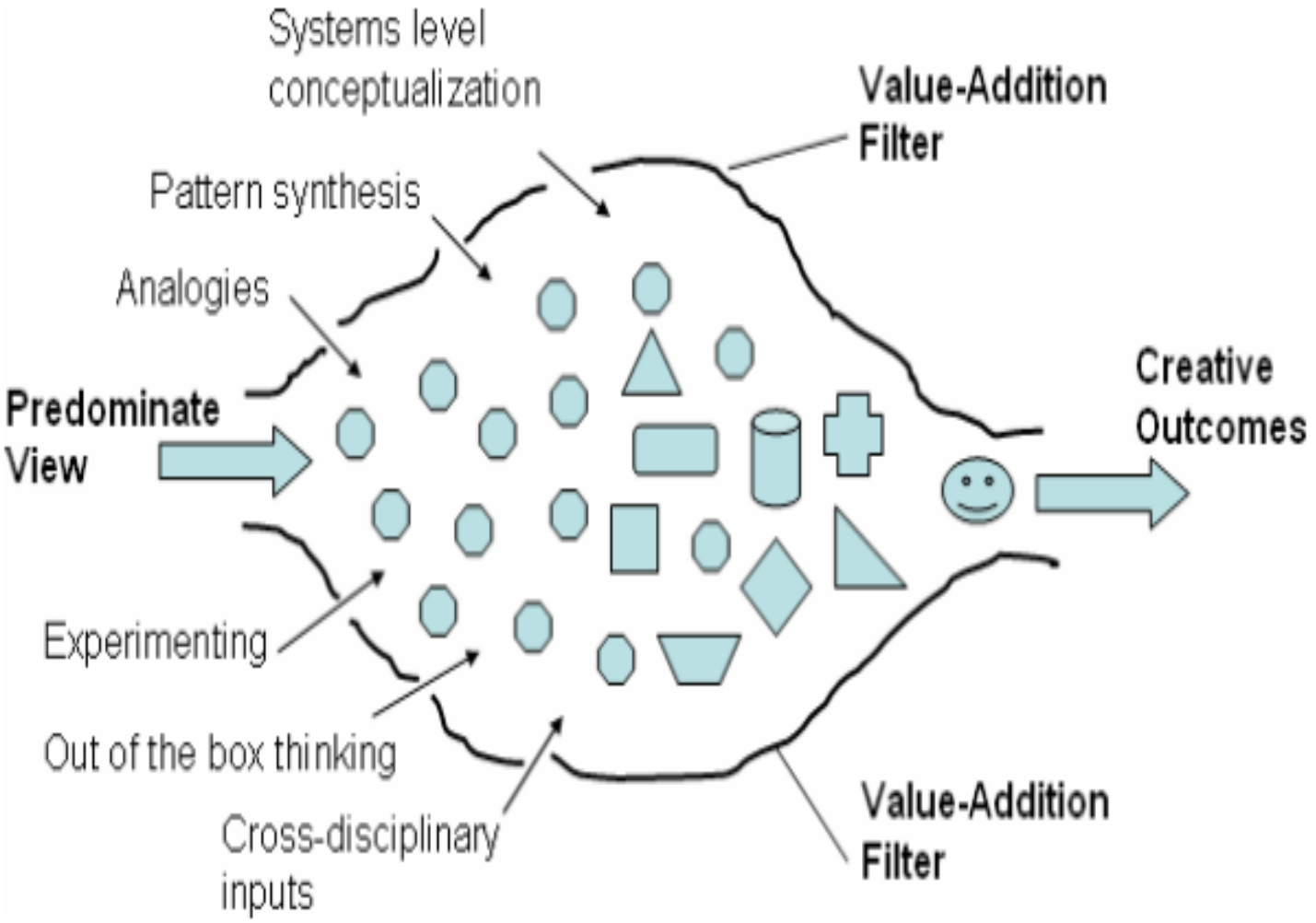


Fig. 4. Divergent and convergent thinking processes.

Some Creative thinking Techniques

- *Brainstorming*
- The Questioning Technique
- Assumption Smashing:
- Attribute Analysis.
- Morphological Analysis.
- Manipulative Verbs.
- Problem Reversal.
- Forced Analogy.
- Metaphorical thinking.
- Trigger Concepts.

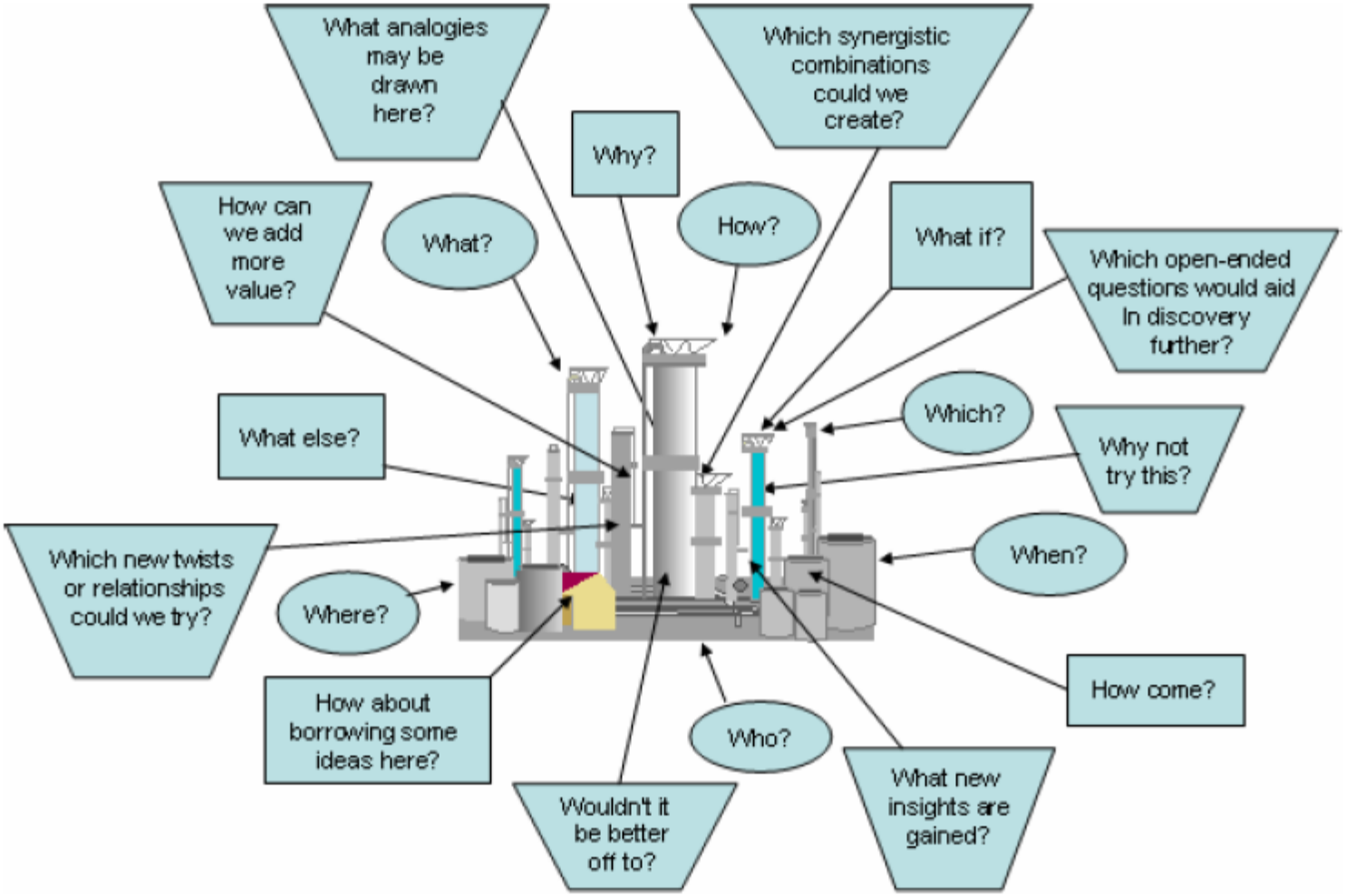


Fig. 3. Deep learning questions [Chang (2006)].

WALLA'S MODEL OF THE CREATIVE PROCESS

- Preparation (A)
- Incubation (D)
- Illumination (C)
- Verification (B)