V. Idea Generation

Exercise: Introduction to Creativity

- Solve this problem....
- Add a single line and turn this into **eight:**

VII

- Easy?
- Now add a single line and turn this into **six:**

IX

- Not as easy?

Creativity as a type of thinking

- Creative Thinking is **generative** not analytical
- Creative Thinking is **divergent** not convergent
- Creative Thinking is concerned with **possibility** not probability
- Creative Thinking is **diffused** not focused
- Creative Thinking is **subjective** not objective
- Creative Thinking looks for **an** answer not **the** answer
- Creative Thinking usually says **"yes and…"** not "yes but…"

Creativity

Positive attitudes for Creativity

- Curiosity.
- Enjoying challenge.
- Not giving up easily: persevering to find a solution.
- Comfortable with imagination / Flexible imagination.
- Being optimistic about the possibility of solutions.

Negative attitudes for Creativity

- Learned helplessness. (failing to respond even though there are opportunities)
- Functional fixation / Prejudice.
- Psychological blocks – negativity, over confidence, etc.
- The best answer/solution/method has already been found.
- Every problem has only one solution (or one right answer).

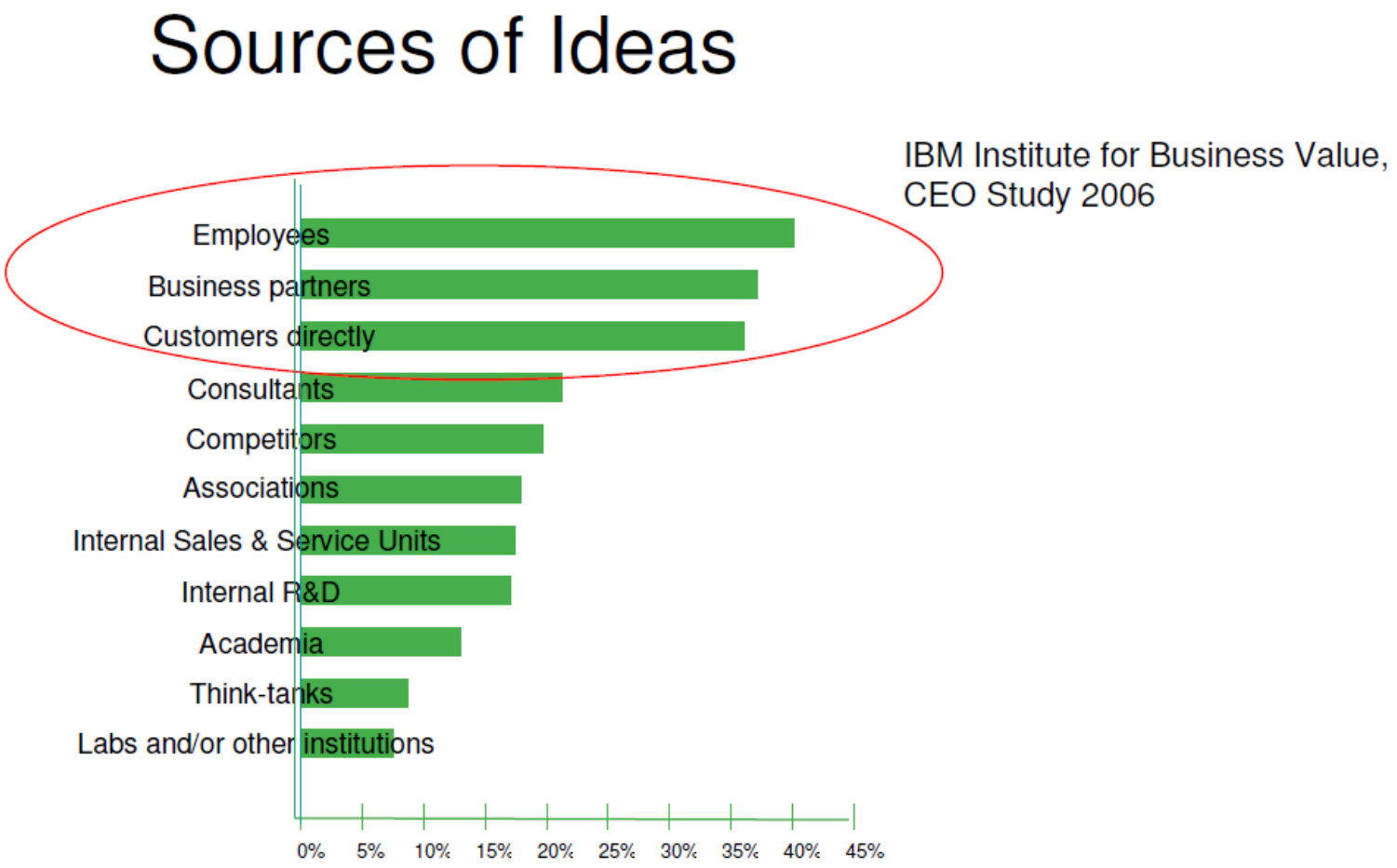
Ways to increase your personal Creativity

1. Stimulate your artistic side through other mediums.
2. Set up a dedicated work space.
3. Become part of a Creative Community.
4. Play! Have Fun!
5. Allow for float time.
6. Meditation / Yoga / Stress Reduction.
7. Just do it – don't think too much about it!!!

Sources of Ideas

- Customers
- Market (competitors, fairs, other countries)
- Creative staff members
- Project team members
- Analysis of technologies
- Idea generation in special sessions or workshops with the help of creativity techniques

Sources of Ideas

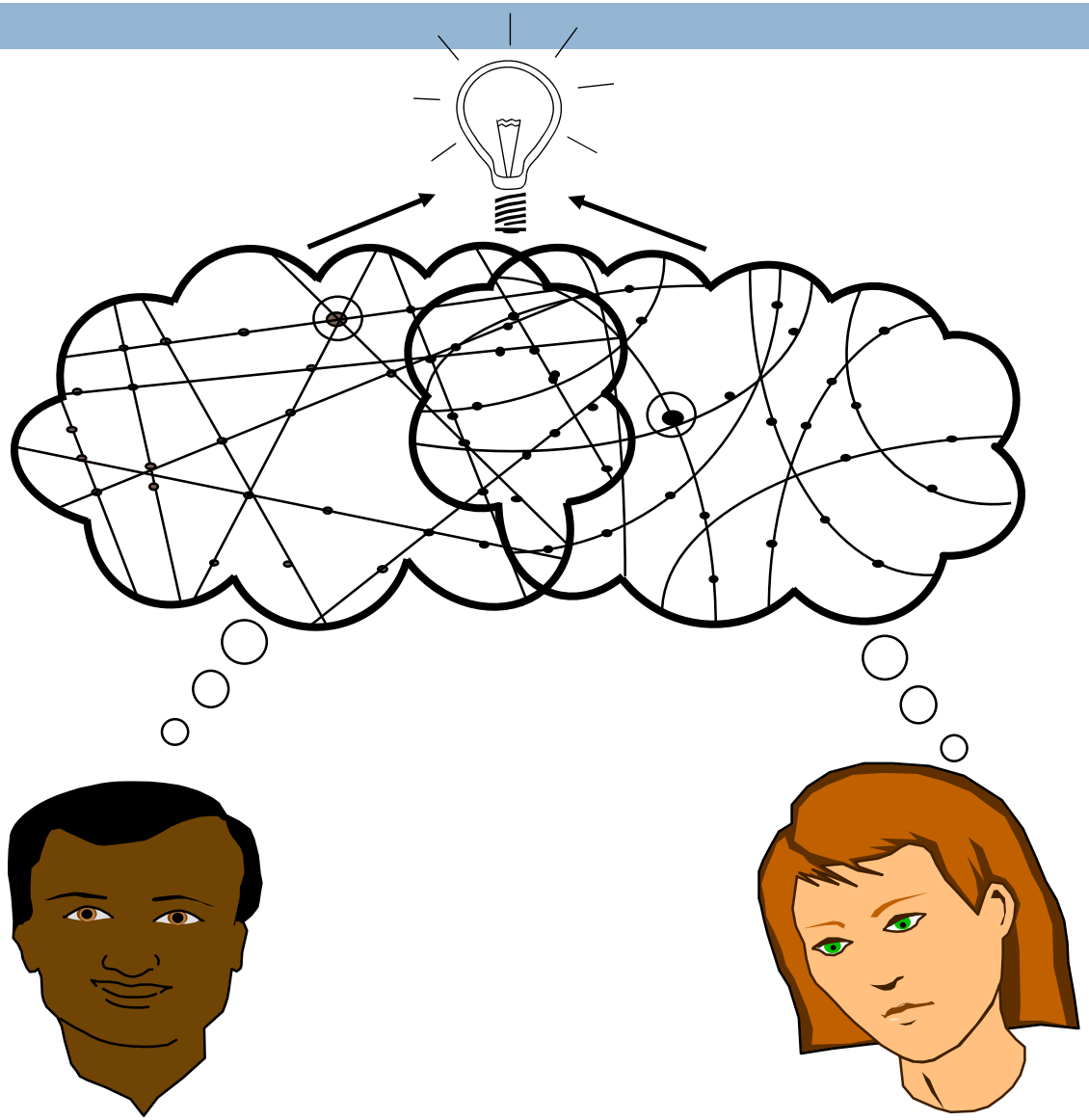


Creativity – Definition

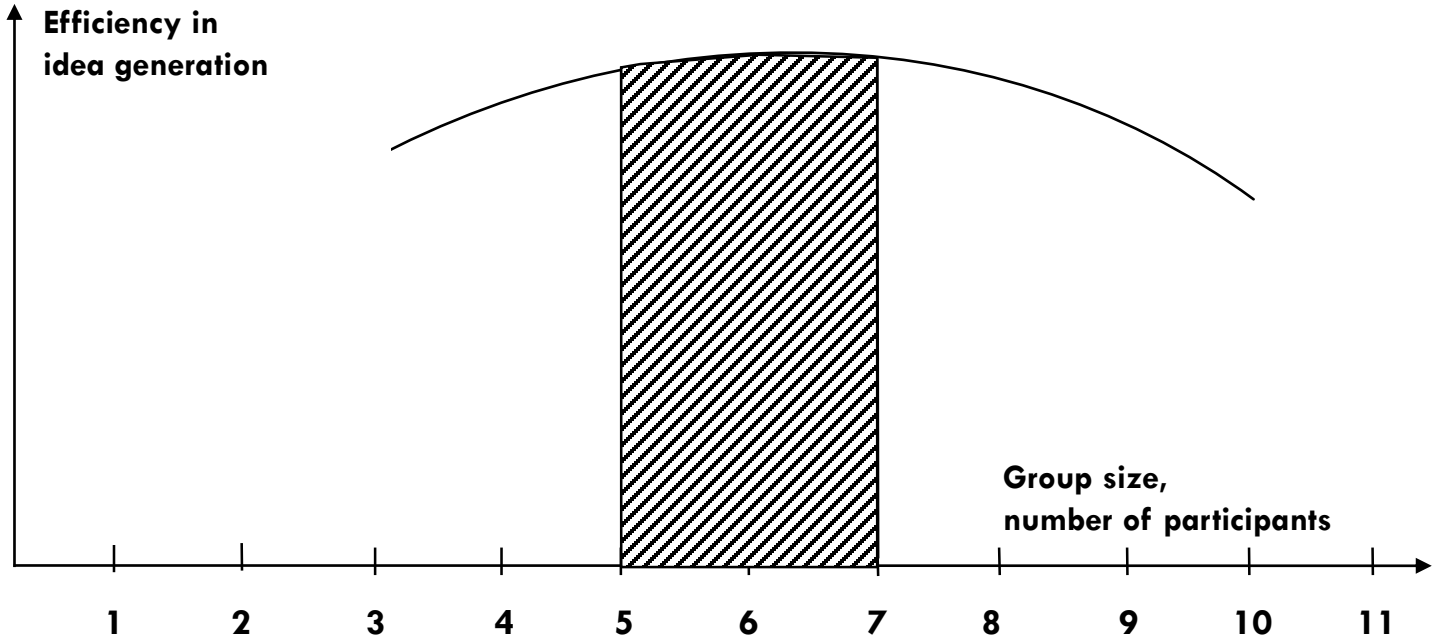
Creativity is the ability of overcoming old-established structures and modes of thinking and combining elements of **knowledge** and **experience** from various areas in such a way as to come up with novel/new and useful ideas.

Creativity in companies is normally directed to solve problems.

A Group Setting Enhances the Creative Potential



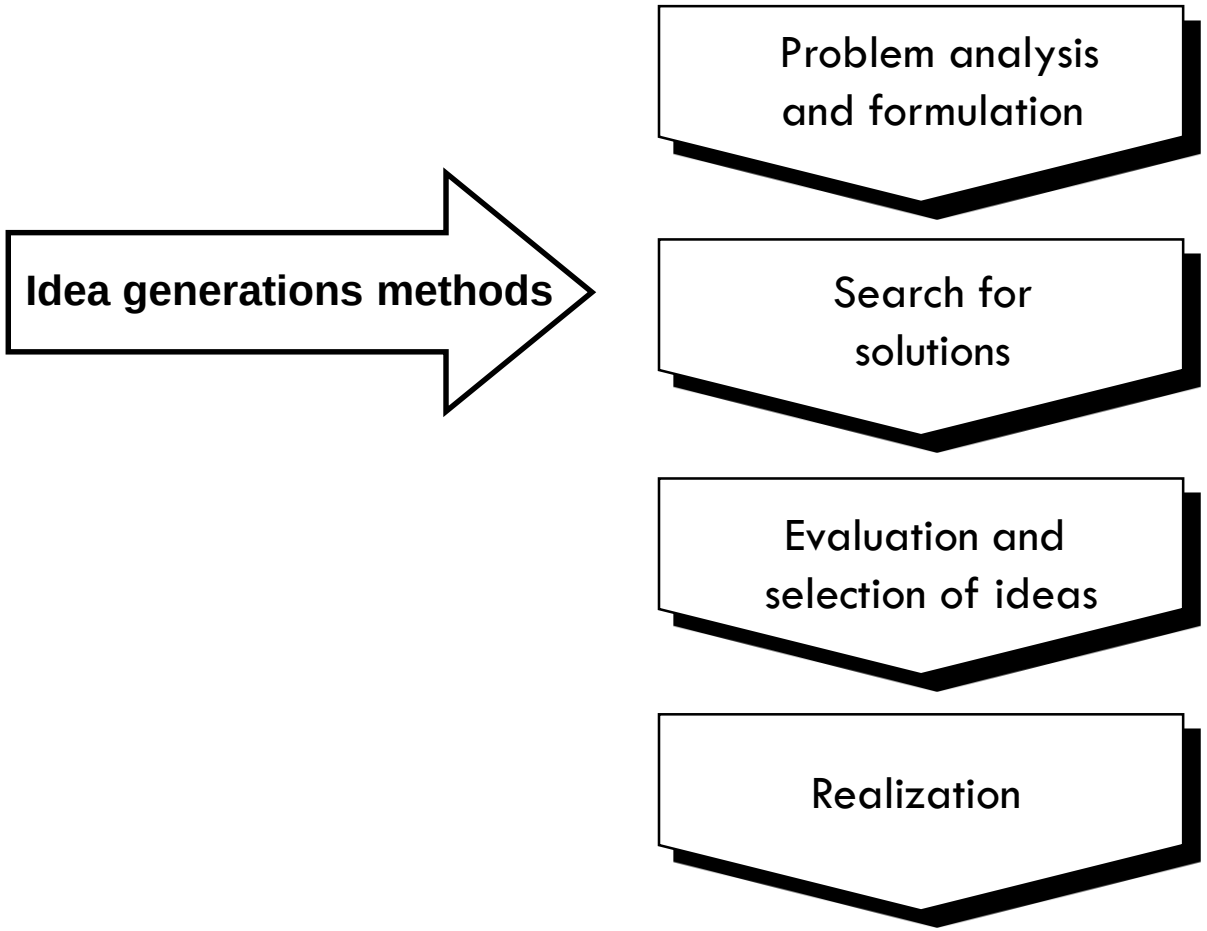
Creative Performance vs. Group Size



Reasons for an optimum group size:

- Additional group members increase knowledge only incrementally.
- Direct communication between all group members must be possible.
- Conformity pressure is lower in small groups.
- Individual responsibility for good results is decreasing with size.

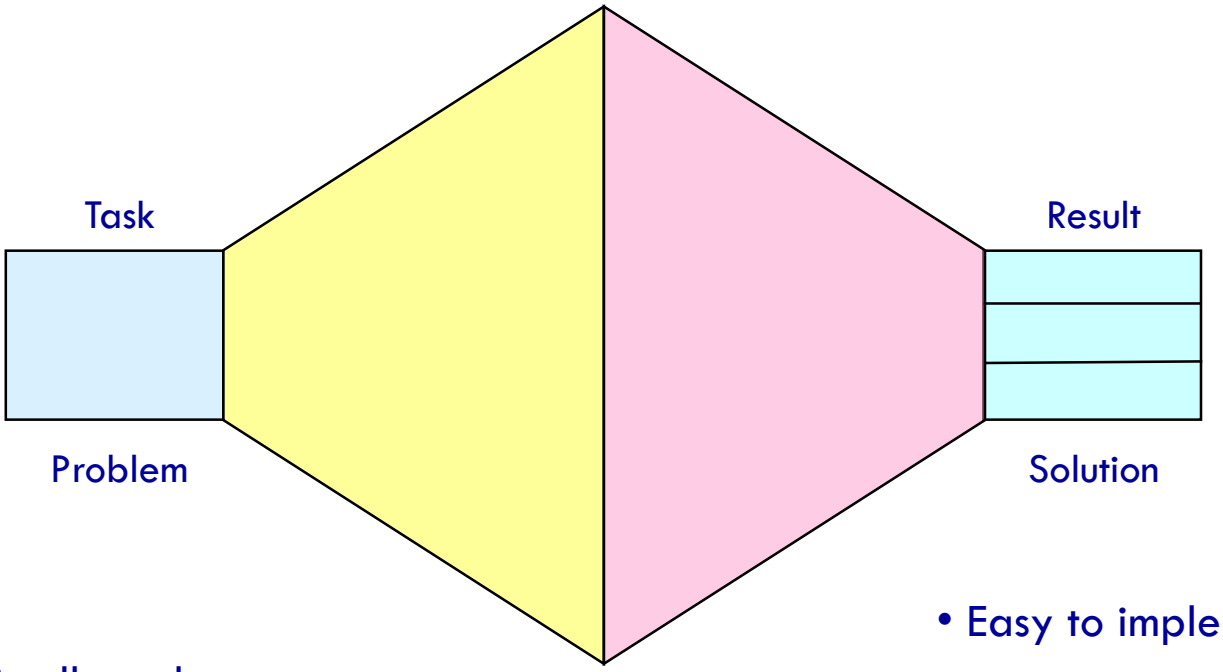
Idea Generation Methods as an Element in the Problem Solving Processes



The Problem Solving Cycle

Divergent Thinking

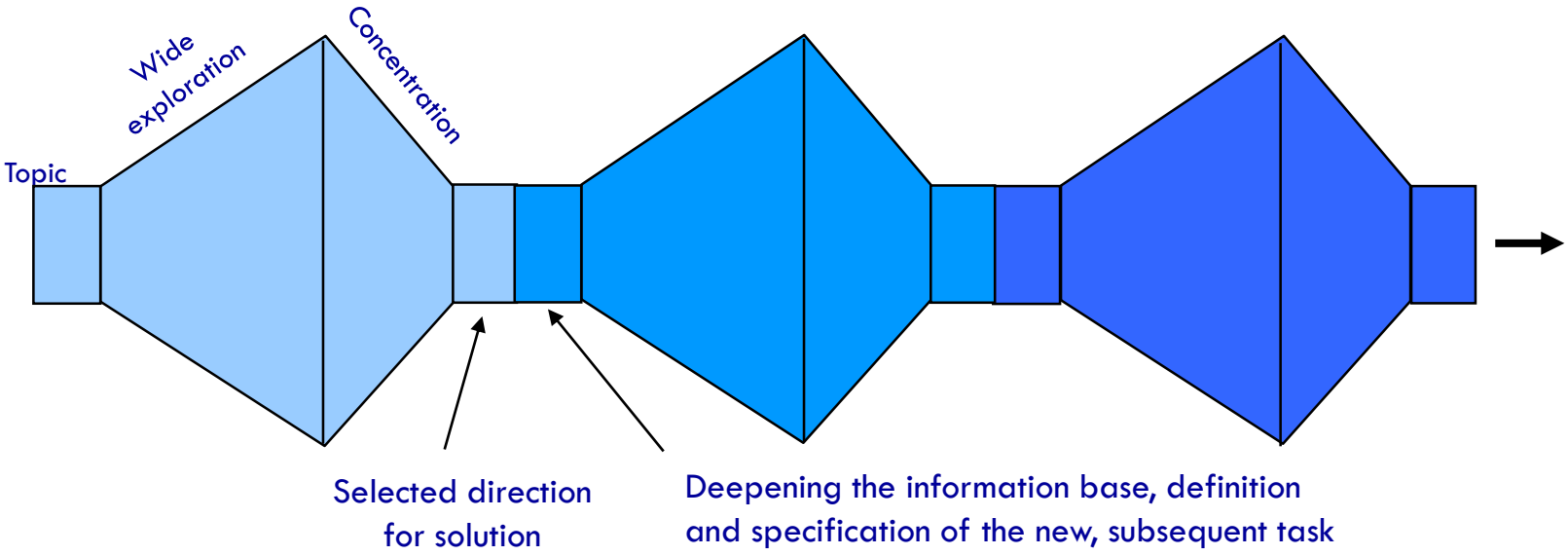
Convergent Thinking



- Open
- Everything is allowed
- Topic is explored
- Many ideas

- Easy to implement
- Advantages
- Economical
- Few suggestions

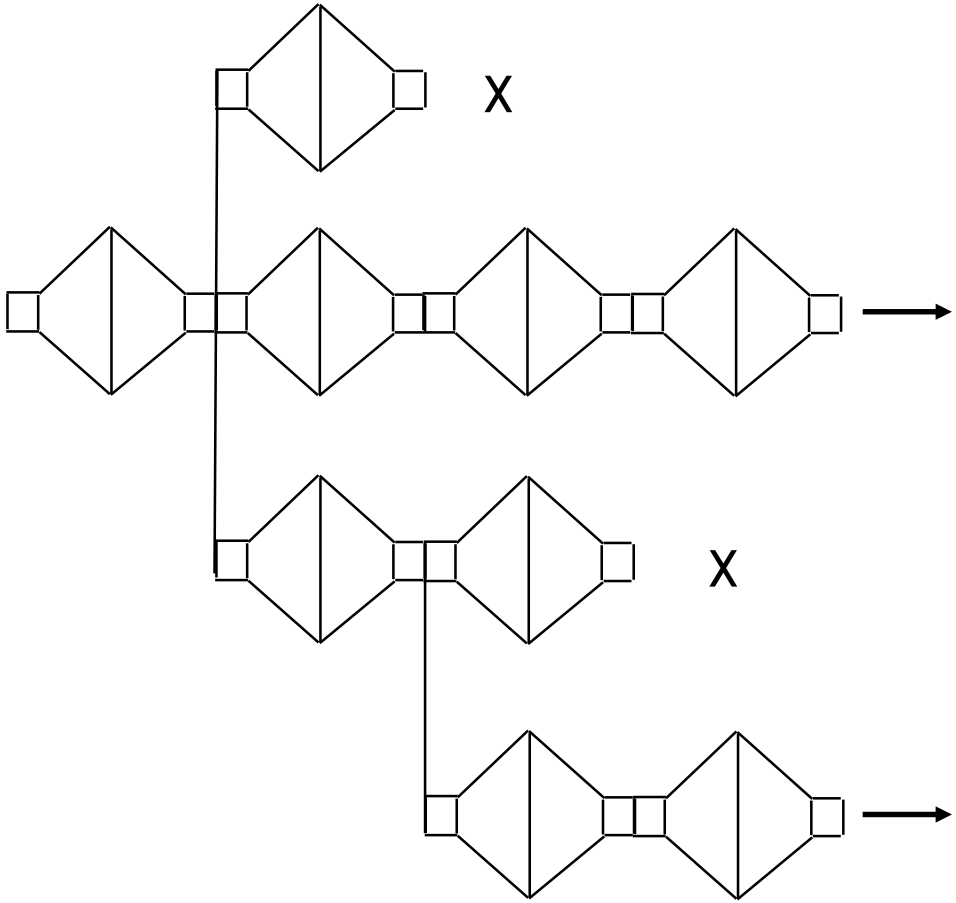
Systematic Problem Solving & Single Problem Solving Cycles are Being Worked Through Sequentially



In each cycle the following steps are run through:

- Definition and specification of the task
- Wide, creative search for solutions
- Selection and focusing on one (few) direction(s) for solution
- Deepening the information base
- Definition and specification of the subsequent task

Parallel and Subsequent Problem Solving Cycles Form the Innovation Process

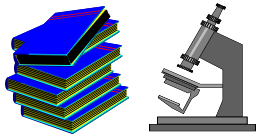


The five Phases of the Creative Process

1. **Formation of a problem consciousness**

- Perception of a problem
- Identification of the problem

2. **Intensive problem solving effort**



- State of knowledge
- Analyses
- Partial, but unsatisfactory solutions

- Frustration
- Urge for finding a convincing solution

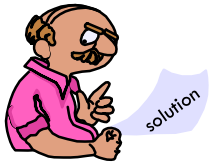
3. **Relaxation and estrangement**

- Local distance
- Relation, no stress
- The subconsciousness is mulling the problem
- Subconscious comparisons

4. **Idea flash**

- Idea flash (in view of unrelated subjects or thoughts)
- Applicability of perceived principles comes into mind
- Presentiment of a solution object
- Vague, fleeting ideas

5. **Follow-up**



- Precise formulation of the idea
- Working out details
- Overcoming obstacles
- Achieving acceptance

Idea Generation Techniques

Techniques of free association

- Brainstorming
- Pincard technique
- Ring exchange technique
- Mind mapping

Techniques of structured association

- Walt Disney's chairs
- Six-hats method

Combination techniques

- Morphological tableau
- Morphological matrix
- Attribute listing

Confrontation techniques

- Synectics excursion
- Stimulating word analyses
- Visual confrontation
- Picture cards brainwriting
- Outdoor confrontation
- Check of invention principles (TRIZ)

Imagination techniques

- Try to become the problem
- Take a picture of the problem
- Guided fantasy journey

Idea Generation Techniques

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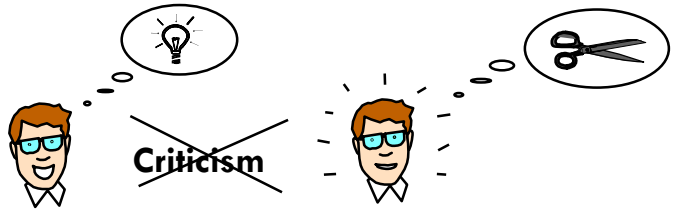
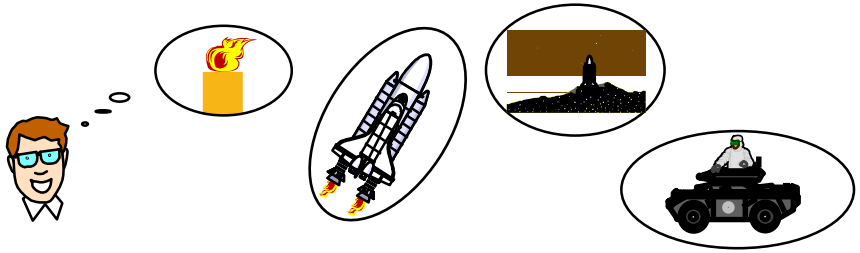
Classical brainstorming
The four basic rules

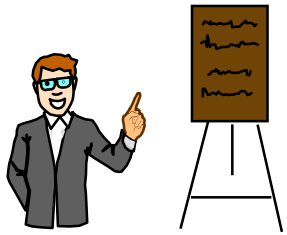
1 Don‘t criticize!



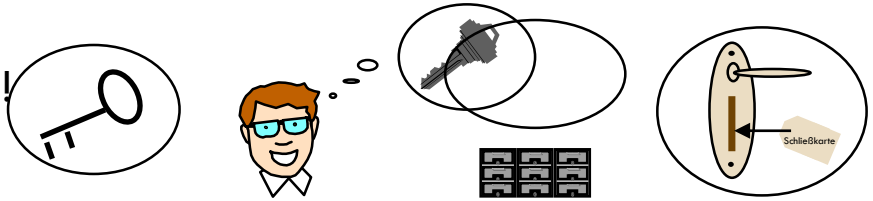
2 Listen and take up ideas!
(associations)



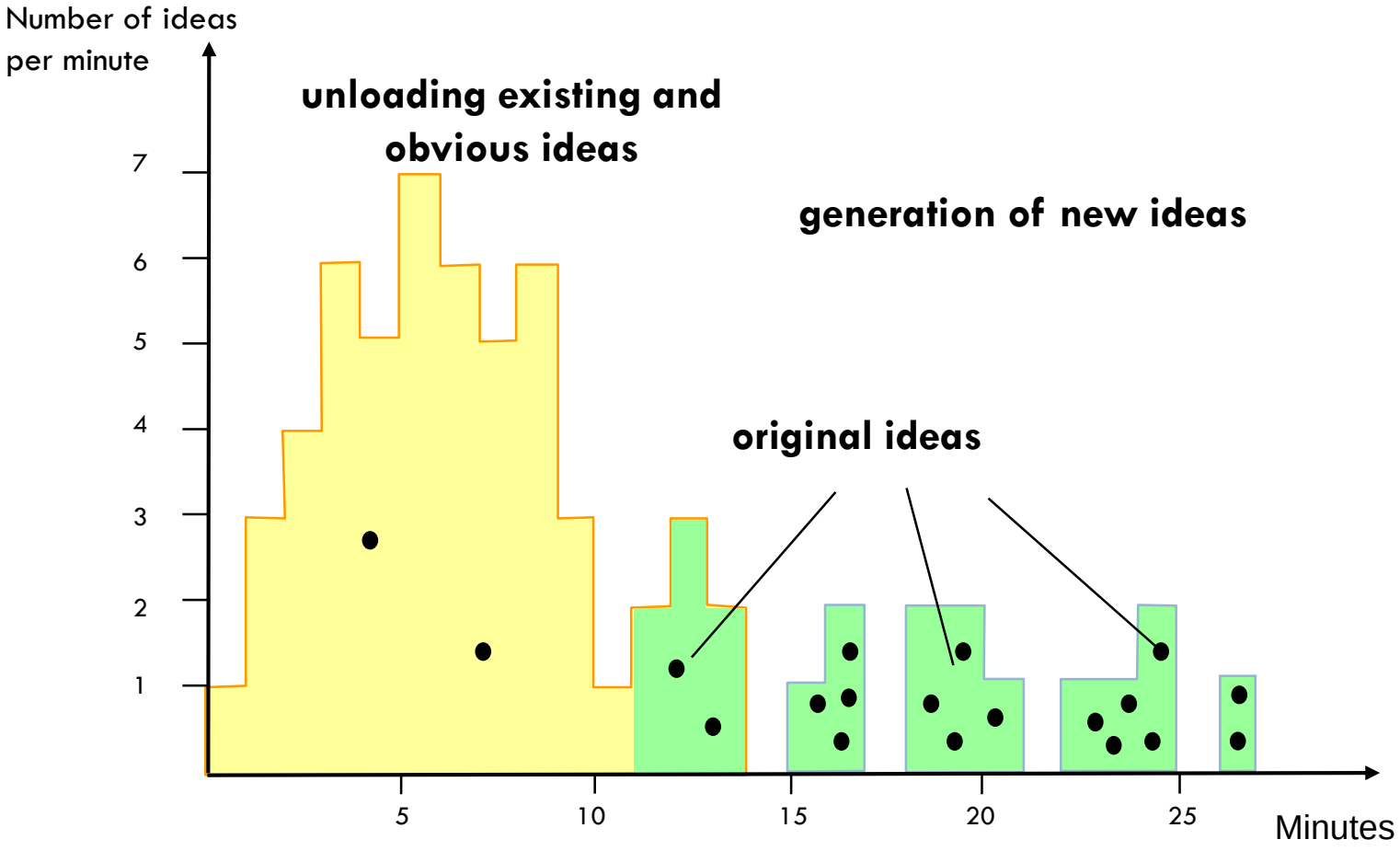
3 Let your thoughts wander!
(free wheeling)



4 Try to produce as many ideas as possible!



Typical Structure of Idea Flow in a Brainstorming Session



Recommendation: Stretch the process even into a phase of feeling uncomfortable

Brainstorming

- The method was first popularized in the late 1930s by Alex Faickney Osborn
- Although brainstorming has become a popular group technique, researchers have generally **failed to find evidence of its effectiveness** for enhancing either quantity or quality of ideas generated. Because of such problems as distraction, evaluation apprehension, and production blocking, brainstorming groups are **little more effective than other types of groups**, and they are actually **less effective than individuals** working independently.
- Although traditional brainstorming may not increase the productivity of groups, it has **other potential benefits, such as enhancing the enjoyment of group work and improving morale**. It may also serve as a useful exercise for **team building**.

Brainwriting

Difficulties with Brainstorming:

- Not enough time for thinking about an idea deeply.
- Unskilled moderators.
- Inadequate notes; ideas are not described precisely.

The concept of Brainwriting tries to overcome these deficiencies:

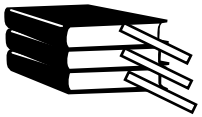
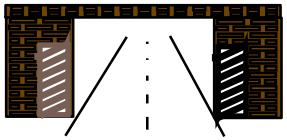
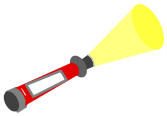
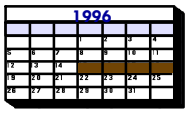
- Ideas are written down by the generators.
- The written ideas are exchanged to stimulate the other participants.
- Different ways to exchange written ideas lead to several Brainwriting variants.

Ring-Exchange Technique

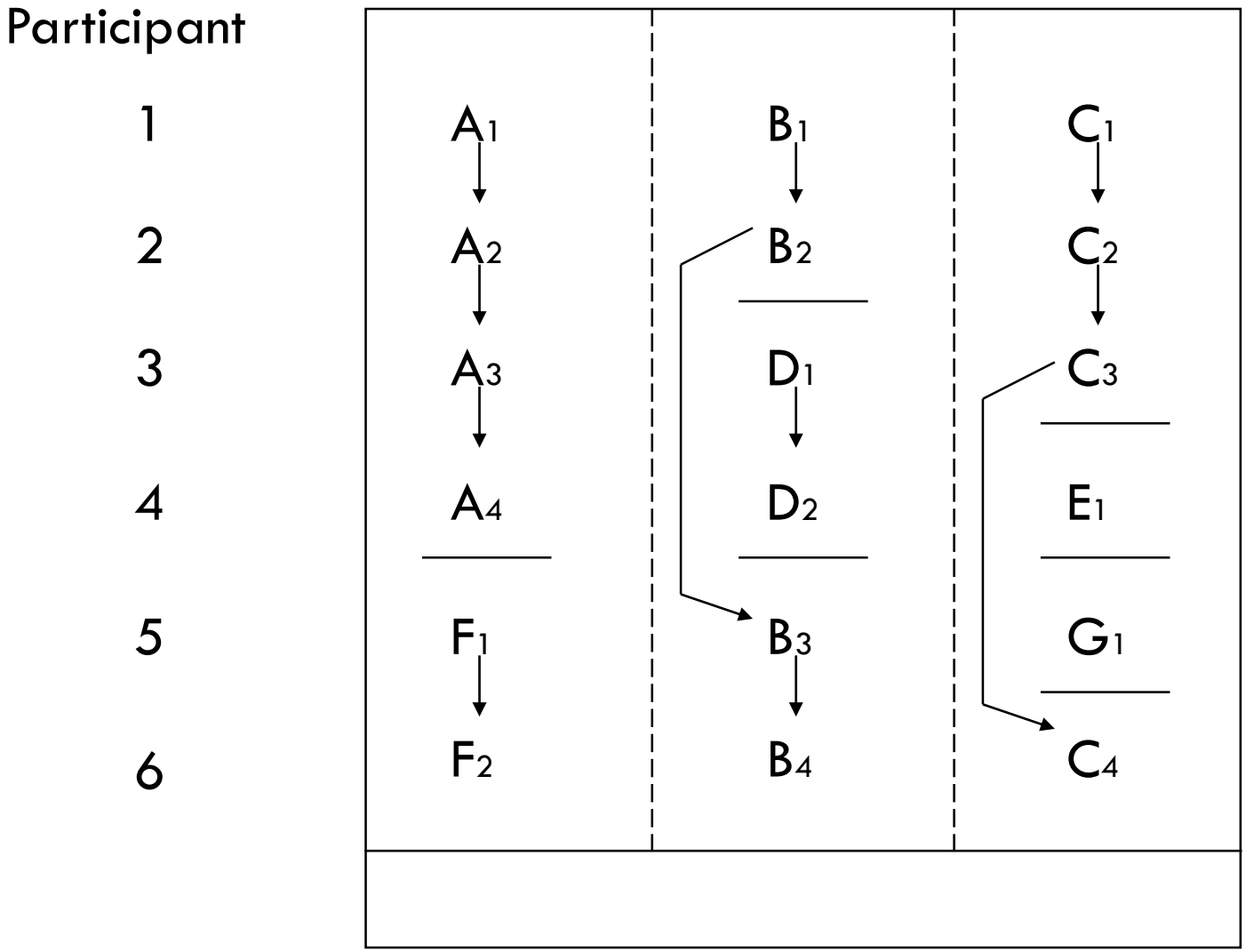
1. A 3-column form is drawn up.
2. Each participant writes down ideas at the top of each column
3. The forms are passed clockwise as soon as all participants have stated these ideas.
4. Each participant writes down an idea in each column, taking his right-hand neighbor‘s ideas as a basis for association. If no association occurs, a new idea should be thought of.
5. The forms are passed again after all participants have filled out associated ideas, however after maximum 5 minutes, time is up.
6. The exchange process is repeated five times.

Ring-Exchange Technique

Problem: New applications for self-adhesive luminous polymer films

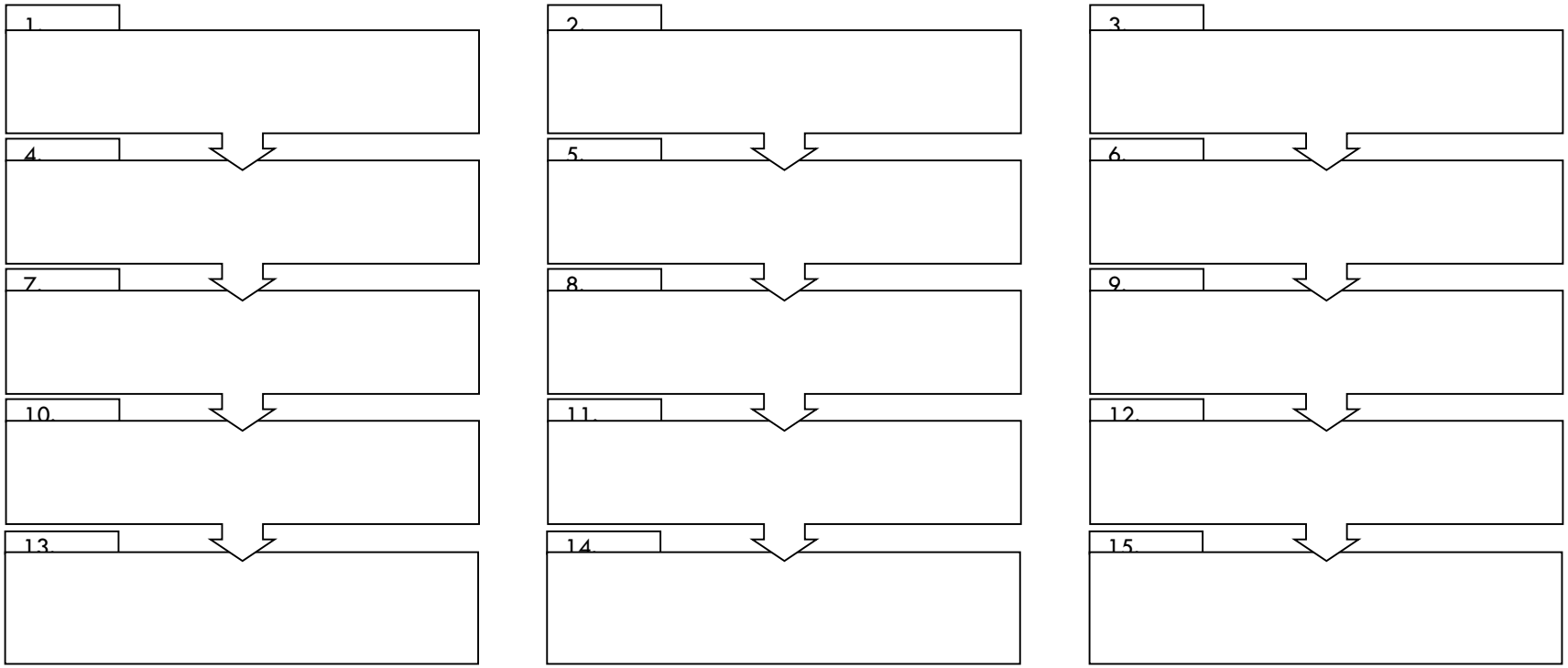
 School children on the road	 Labels	For children‘s handicraft in the Kindergarden
	Marking of bestsellers in a bookshop	Marking of medicine chests
	 Price tags on used cars	 Marking of flashlights
 Safety jackets	Price tags on special offers	Marking of the ignition lock
Life jackets	 Safety exit signs	 Reminder
 Entrance guides in department stores	Marking of building or road construction and farm vehicles	 Marking of important dates

Association Chains in a Ring-Exchange Form



Ring-Exchange Technique Working Sheet

Please write three ideas into the boxes of one line (1-3;4-6;etc): One idea in one box.



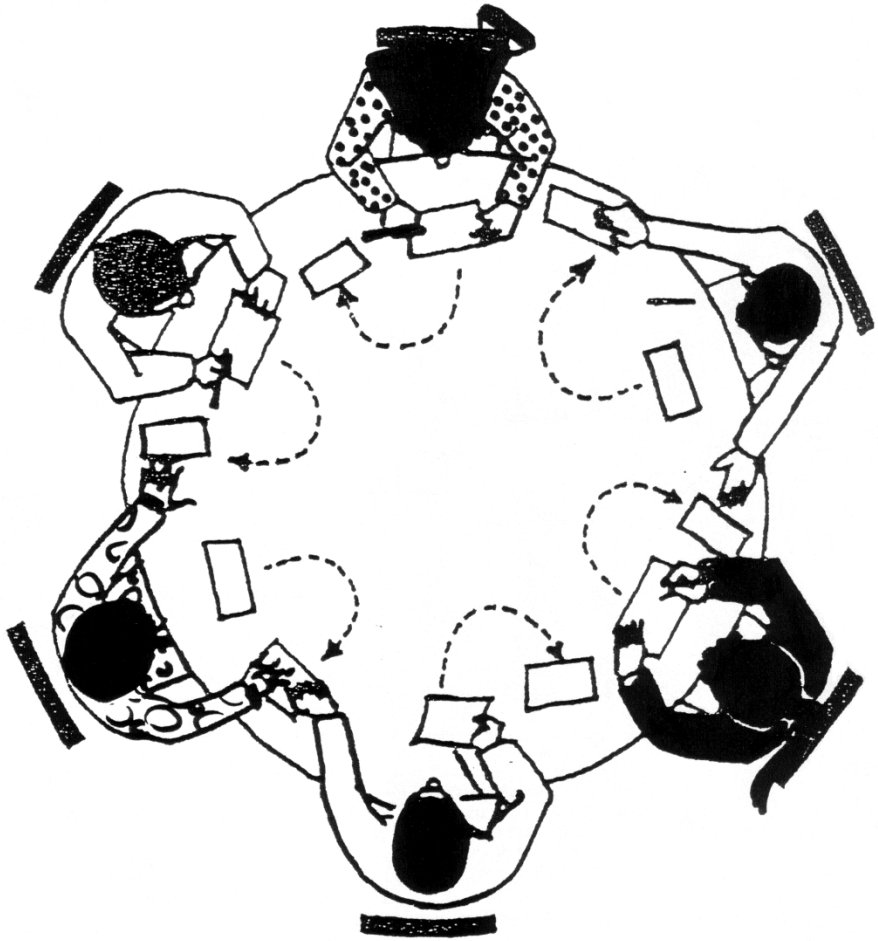
Please indicate in the little boxes below (I,II,III,etc) the number of the boxes of the three best ideas. After having entered the three numbers fold the cut backwards.

I	II	III	IV	V	VI	VII	VIII

Pin Card Technique

Phase I: Idea Generation on Circulating Cards

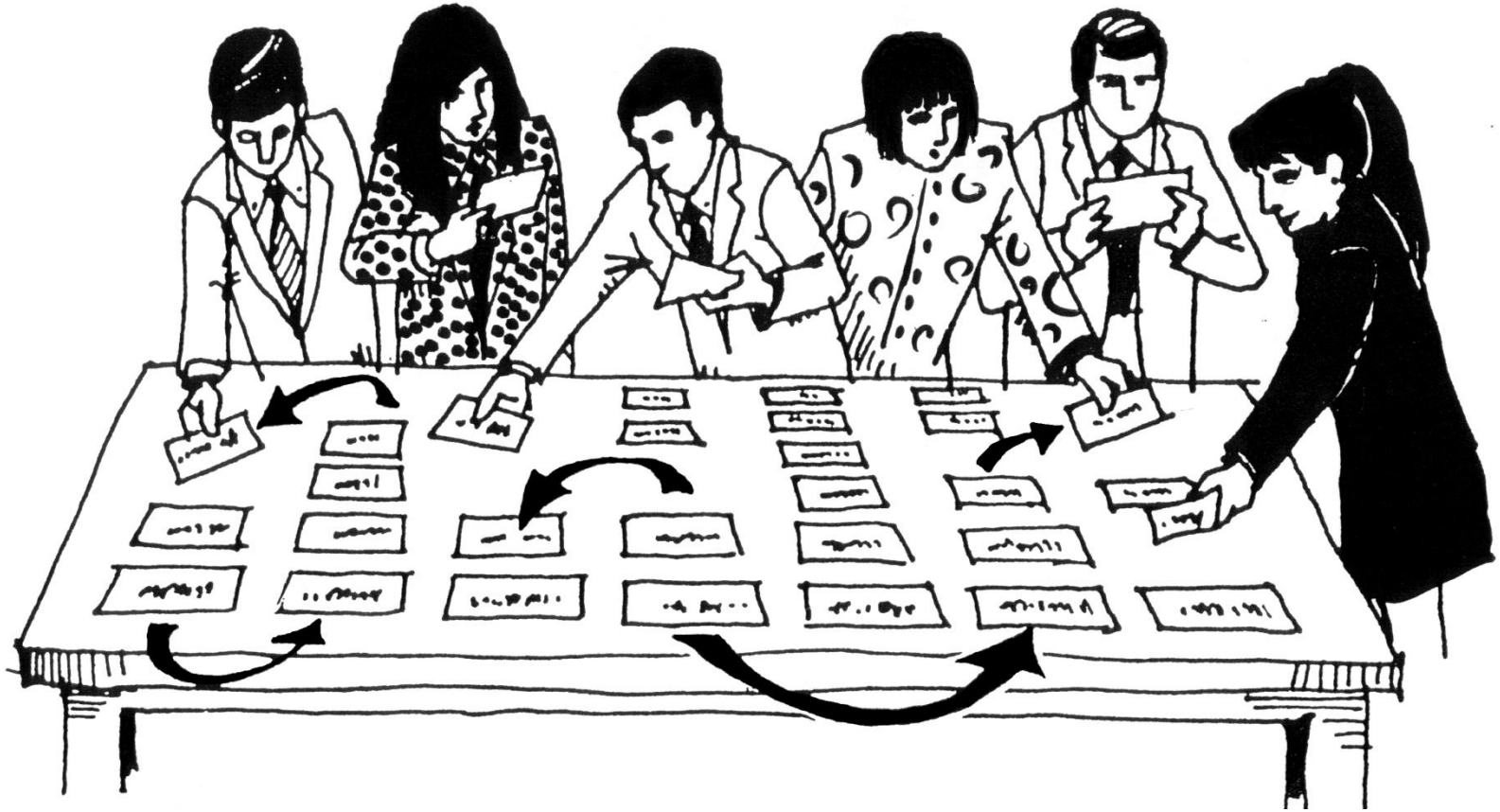
Write one idea on a card and put the card to the right.



Pick neighbor´s card, read, associate, and put all cards to the right.

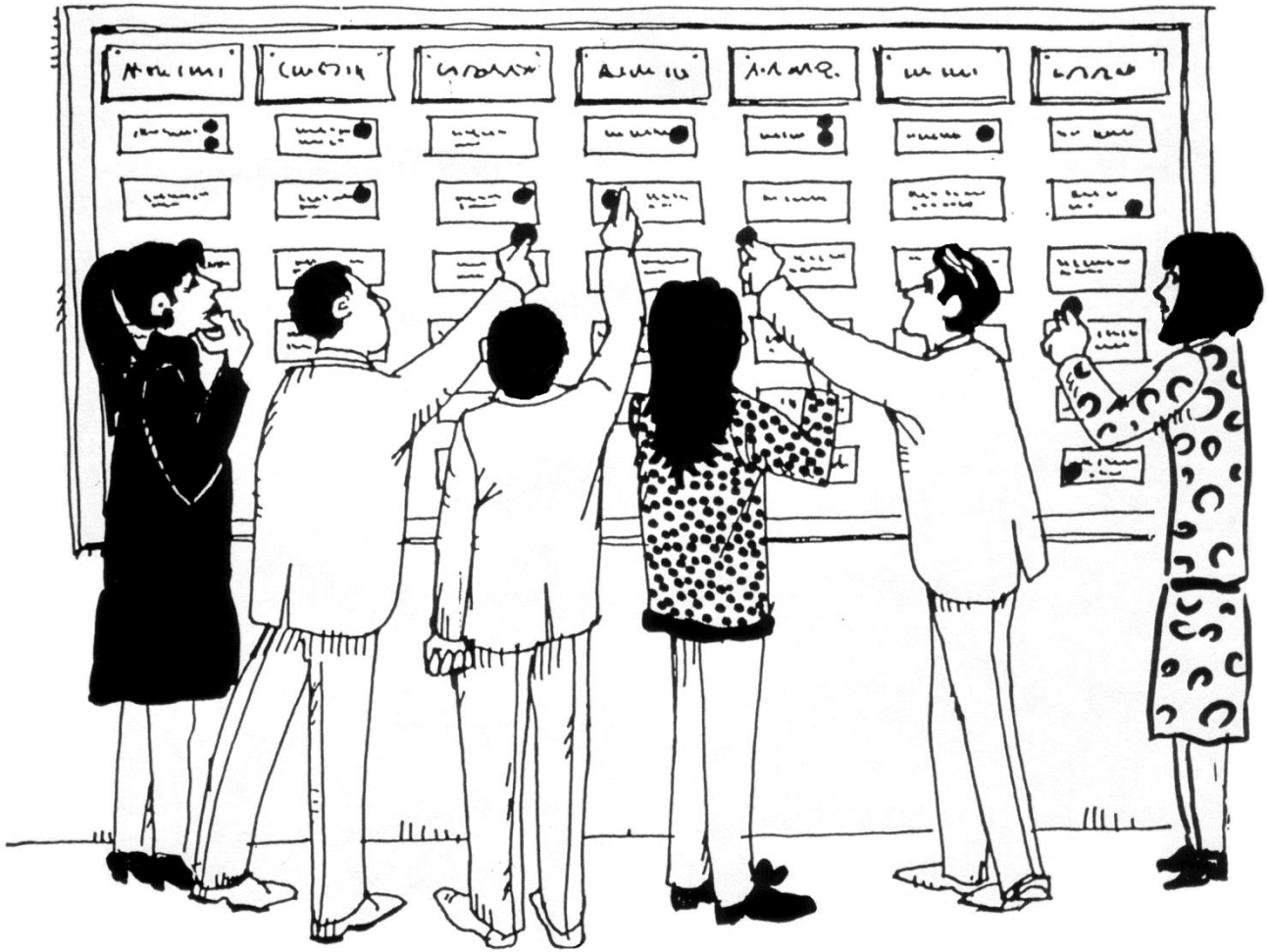
Pin Card Technique

Phase II: Clustering the Ideas



Pin Card Technique

Phase III: Prioritizing by Distribution of Dots

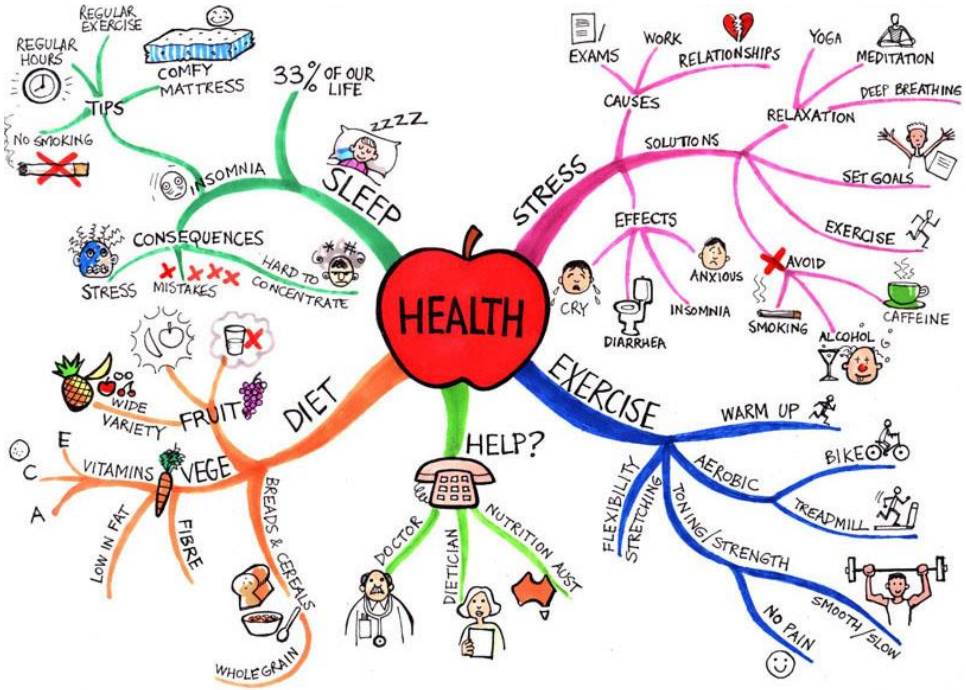


Pin Card Technique

- Description and definition of the problem.
- 5 - 7 persons write short notes about ideas on individual cards (one card per idea).
- The cards are passed on clockwise.
- A participant who has no more new ideas reads the cards which his right-hand neighbor passed on to him, and if he associates new ideas he writes these down on separate cards.
- The process is discontinued after 20 to 30 minutes and the cards are roughly sorted. They are then clustered according to topics, double entries are eliminated, and the cards are put on a pin wall. The cards are usually moved several times until the clusters are consistent.
- The various clusters are given headings.

Mindmapping – Concept

Using mindmapping, **strictly analytical thinking and linear rectangular mapping <u>are replaced</u> by a «natural way of structuring»**. Both hemispheres of the brain are used simultaneously; **pictorial-spatial thinking** is activated; the capacity for remembering is strengthened.



The mindmap follows the analogy of a slice through a tree. The topic forms the tree trunk, subtopics, aspects and ideas are divided into main branches, branches and twigs.

The mindmap emerges from an alternation between the branches and twigs. It can be complemented and differentiated at any time afterwards.

Mindmapping - Proceeding

Material

- Plain white sheets of paper, DIN A4 landscape format
- Pencils in various colors and thickness

Procedure

- Write down **the topic as one word, symbol or picture in the middle of the page**. Draw a circle or box around it.
- Write down your first thought as a keyword on a thick line (branch) top right (position at one o'clock). The keyword has to be on top of the line and readable horizontally.
- Further thoughts are to be integrated dependent on whether they are associated with the already existing branch or describing a new main thought. For new main thoughts new main branches are established clockwise. Associations are added as finer lines (branches or twigs).

Mindmapping - Proceeding

- Let your thoughts flow freely, also crazy thoughts are welcome.
- **When the streaming of thoughts slows down one should break up and complement, correct, and restructure the map**.
- Further aspects should be looked for at a later time.

Further rules

- Preferably use only one single keyword or symbol per line.
- Insert pictures and symbols wherever possible.
- Draw your first creative maps rather with pencil and eraser.
- Use various colors.
- **The lines of branches and twigs all have to be interconnected.**

Confrontation Techniques - Characteristics

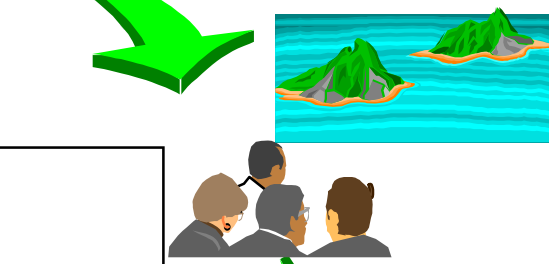
- Basis of the confrontation techniques is the **individual creative process.**
- The common mechanism of these techniques is the **triggering of ideas through unrelated objects, processes or any other impressions or thoughts.**
- Idea generation through confrontations requires an uncommon way of thinking. Therefore, one has to get familiarised or even trained in this form of creative thinking.
- Confrontation techniques should be applied when **really original ideas** are searched for. Typically the results from these techniques vary considerably with respect to relevance, concreteness and level of consideration, but there is a good chance that totally new solution ideas emerge.

Visual Confrontation

Methods:

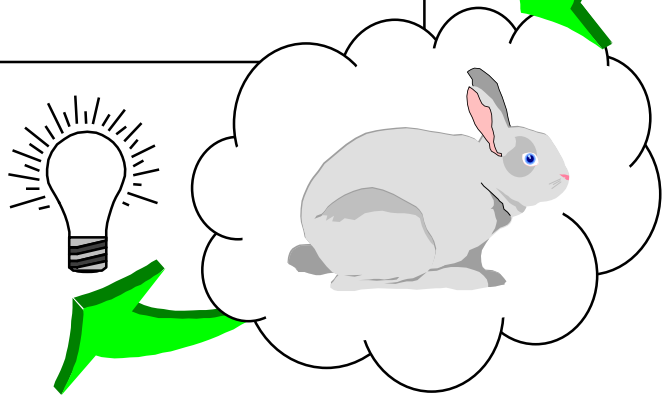
- Visual confrontation in groups
- Picture cards brainwriting
- Outdoor confrontation

Problem



Principals:

1. Estrangement and relaxation by means of pictures
2. Confrontation with picture elements

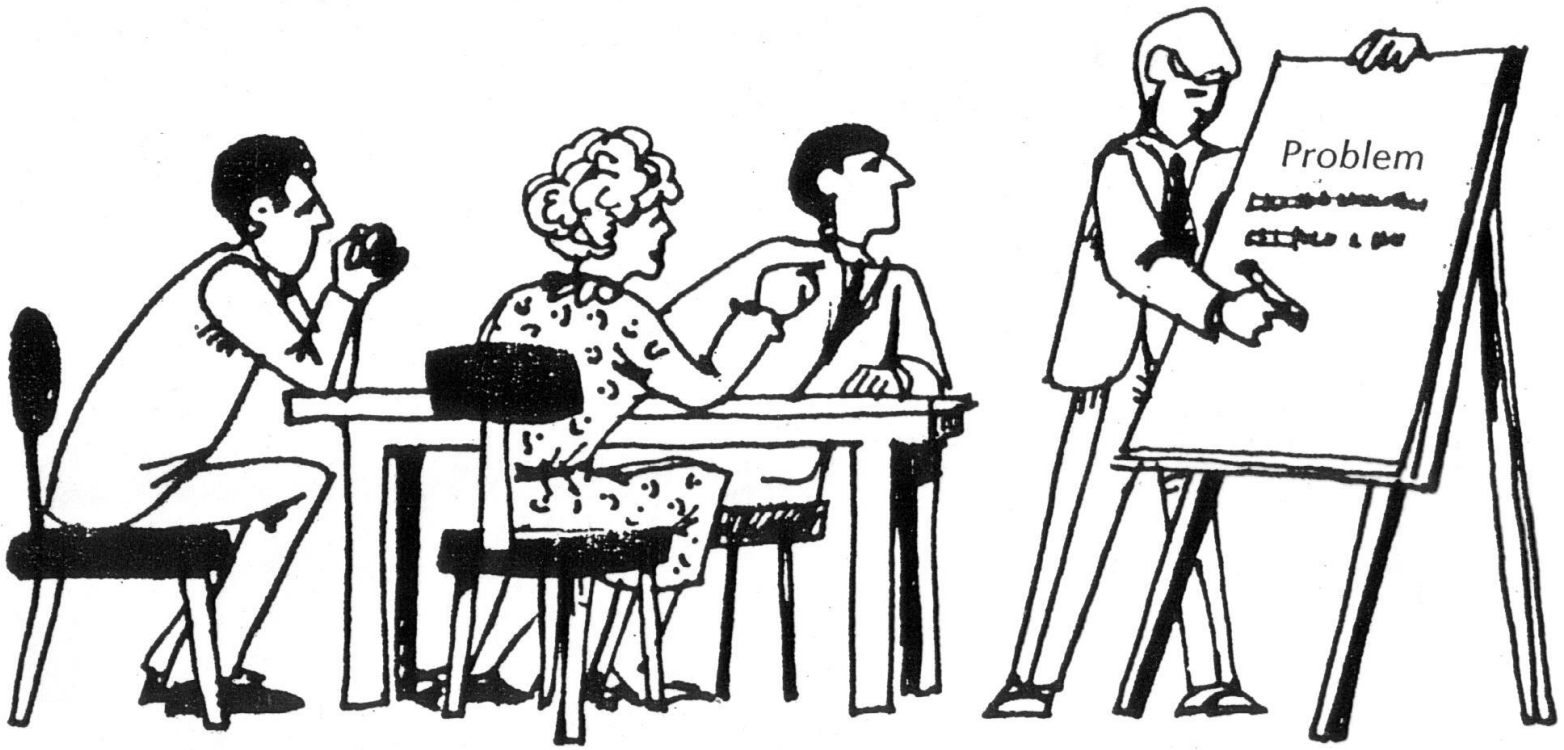


Solution

Confrontation Techniques

- Synectics excursion
- Stimulating word analysis
- Picture Folder Brainwriting
- **Picture Cards Brainwriting**
- Outdoor Confrontation
- Technical Principles (TRIZ)
- Provocation technique
- Principles of the nature

Visual Confrontation in the Group



Phase I: Clarification and Definition of the Problem

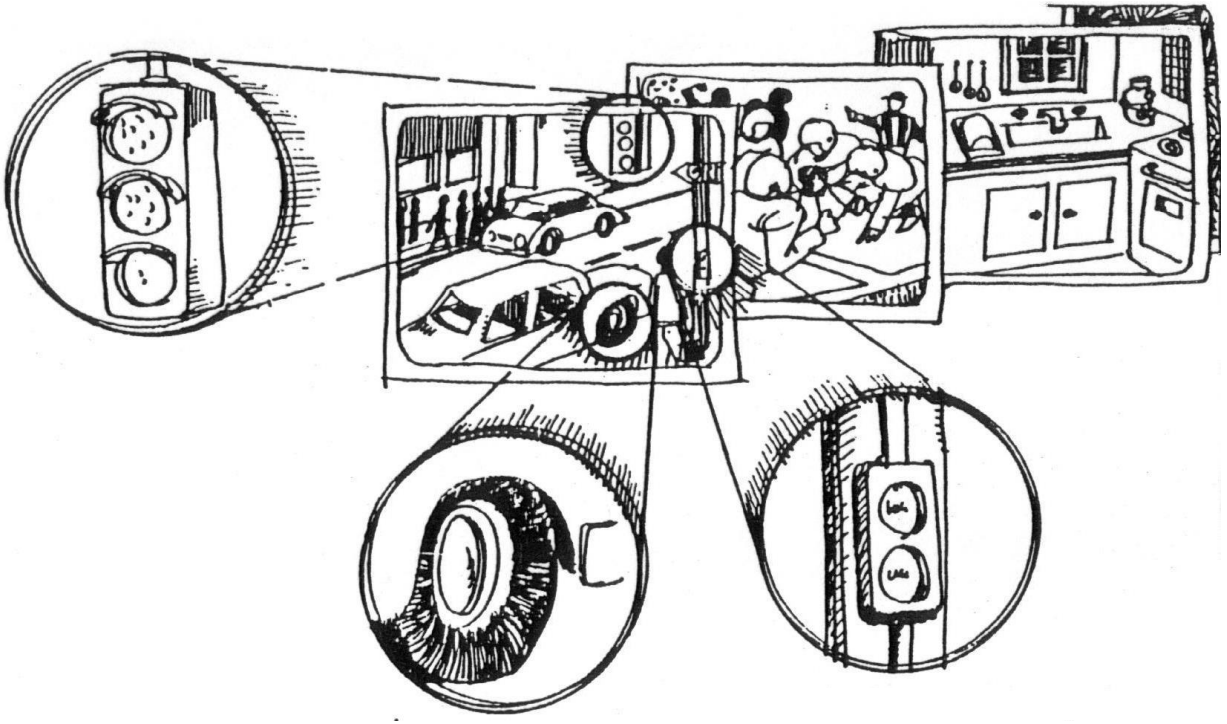
Visual Confrontation in the Group

Phase II: Relaxation and Estrangement

Visual Confrontation in the Group

Traffic Light

1. Lights off/on
2. Sequential
3. Color Code



Tire

1. Continuous
2. Tread Pattern
3. Pressure
4. Inflate

Switch

1. Push Bottom

Phase III: Idea Generation by Intuitive Confrontation with Picture Elements

Steps of Visual Confrontation in the Group

1. Clarification of the Problem

- Explanation
- Questions and answers
- Precise, narrow definition

2. Unloading the Mind

- Quick brainstorming
- Check of brainstorming ideas
- Reformulation of the problem, if necessary

3. Relaxation and Estrangement

- Looking at ‘soft’ pictures
- Exposed to background music
- Dreaming away

4. Development of Ideas from Picture Elements

- Analyzing pictures with respect to inherent priciples
- Deriving ideas from principles by transferring them to the problem

5. Further Development of the Ideas

- Screening
- Combining
- Detailing

Visual Confrontation – an Example

Problem: A new concept for garden furniture should be developed overcoming weaknesses of actual furniture.

Pictures are shown and analyzed.

Desk with a drawer:	Sliding elements are integrated in the furniture pieces. They can be pulled out and fastened on the opposite side thus forming a tarpaulin.
Stacked pales of straw:	Furniture designed in a way that the pieces are joined in a compact way. A cover protects the pack against bad weather.
Shelter in the mountains:	Garden shed matching the furniture in its style. The furniture can be stored quickly and compactly.

Visual Confrontation – Some Examples

- New applications for blast furnace slag
- New design for a bottle stopper portioning device
- Pedicure products
- Accessories for wood processing machines
- Interfacess for electronical devices
- Instruments for body care
- Components for sewage purification
- New ice products
- Elaboration of a slogan
- Application of a pesticide without contaminating effects in the soil

Steps of Picture Cards Brainwriting

1. Explanation and analysis of the problem; precise problem definition by the group (20 - 30 minutes)
2. Quick brainstorming (ca. 5 minutes)
3. Check and possibly reformulation of the problem definition (ca. 5 minutes)
4. Idea generation with picture cards (ca. 20 minutes)
   Special pictures are distributed to the participants (ca. 30 pictures per group)
   They are analysed individually: From principles seen in the pictures, ideas are derived and written down on pincards.
   The pictures are exchanged among the participants.
5. Afterwards: Idea generation by passing the cards around (ca. 10 minutes)
6. Sorting the idea cards on a table (ca. 15 minutes)
7. First spontaneous evaluation by sticking dots (ca. 10 minutes)

The 40 Inventive Principles to find Technical Solutions (according to Altschuller)

The **"forty principles" of TRIZ** are **basic engineering parameters of common objects,** such as weight, length, and manufacturing tolerances. TRIZ methodology claims that by studying an individual parameter which is causing a problem and the other parameters which are in conflict with it, engineering solutions can be created for invention problems.

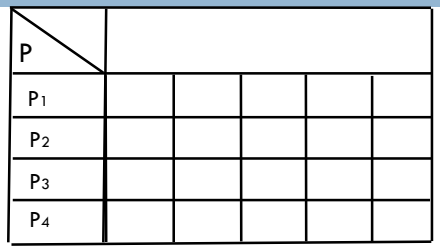
1. Segmentation
2. Taking out or Extraction
3. Local quality
4. Asymmetry
5. Merging/consolidation
6. Universality
7. Nested doll
8. Anti-weight
9. Preliminary anti-action
10. Preliminary action
11. Beforehand cushioning
12. Equipotentiality
13. The other way round
14. Spheroidality - curvature
15. Dynamics
16. Partial or excessive actions
17. Another dimension
18. Mechanical vibration
19. Periodic action
20. Continuity of useful action

The 40 Inventive Principles to find Technical Solutions (according to Altschuller)

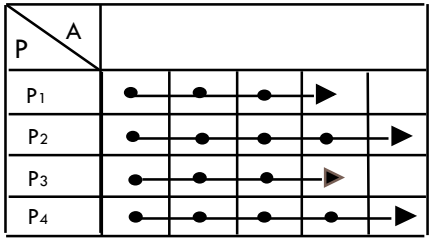
21. Skipping/rushing through
22. Blessing in disguise – arm to benefit
23. Feedback
24. Intermediary/ediator
25. Self-Service
26. Copying
27. Cheap short-living objects
28. Mechanics substitution
29. Pneumatics and hydraulics
30. Flexible shells and thin films
31. Porous materials
32. Colour changes
33. Homogenity
34. Rejecting, dicarding – recovering, regeneration
35. Parameter changes
36. Phase transitions
37. Thermal expansion
38. Accelerated oxidation
39. Inert atmosphere
40. Composite materials

Morphological Tableau

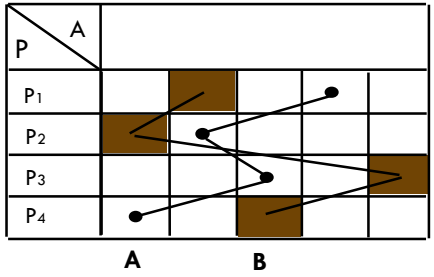
1. Identification of the elements of the problem (parameters) to be listed in the first column



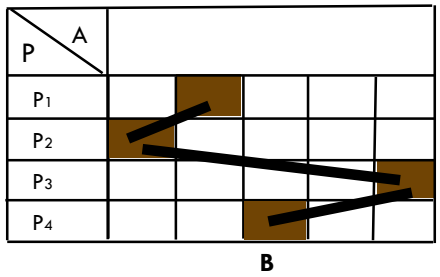
2. Search for partial solutions (options) for each parameter



3. Development of overall solutions by connecting elements through lines; each line representing a possible solution



4. Analysis and pinpointing of the optimum overall solution, e.g. „B“

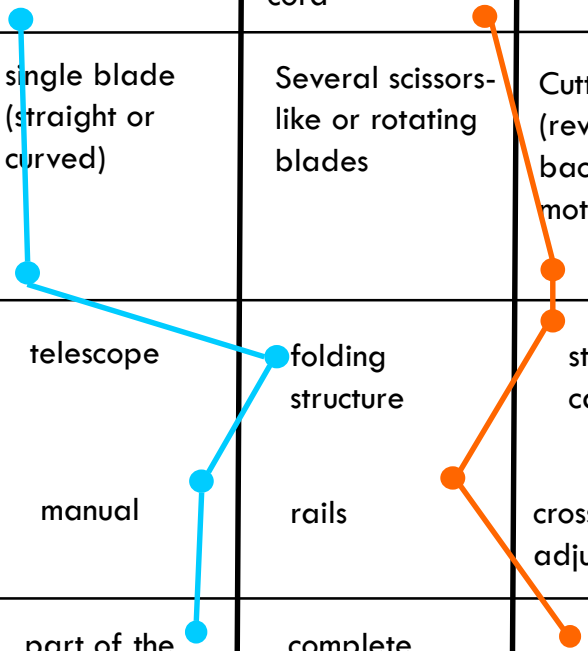


Morphological tableau for a coffee machine

Parameters	**Potential solutions** (values; here limited to three for each problem)		
..boil water	heating coil (built in)	hot plate or open flame (external)	chemical reaction producing hot water
..dispense coffee powder	by hand, with spoon	built-in measuring cup	integrated dispensing
..filter	filtering paper	porous porcelain	electrostatic precipation
..keep warm	heat insulating material	addition of heat	heat retaining hood
..pour coffee	tap	pumping unit	second container, pour out
Solutions (examples)	**K1** boil = chemical reaction dispense = integrated unit filter = ceramic filter keep warm = insulating hood pour = tap		**K2** boil = heating coil dispense = integrated unit filter = filter paper keep warm = heat addition pour = second container

Morphological Tableau for a Hedge Clipper

Parameter	Design alternatives (values)					
Drive	manual	electric powder cord	elektric, battery-driven	combustion engine		
Cutting unit	single blade (straight or curved)	Several scissors-like or rotating blades	Cutting chains (revolving or back-and-forth motion)	one or several saw blades	Cutting or sawing disk	Cutting beam
Carriage unit	telescope	folding structure	stationary carriage	insert (add-a-unit design)		
Guidance of carriage unit	manual	rails	cross-span adjuster	optical guide beam	with distance control	electronic
Range of action of cutting unit (single run)	part of the hedge front (not complete Height)	complete hedge front	top of the hedge	hedge front plus top	Allround clipping	



Morphological Tableau for a Garbage Separation System

Parameters	Solution Options				
Garbage collection	Conveyorbelt	Hopper	Flap	Bunker	Container (stationary)
Determine composition	Optical screening	Chemical analysis	Mechanical analysis		
Transportation	Crane	Chute	Shaking belt	Belt loader	Conveyor belt
Processing	Shear	Grinder	Hammer mill	No processing	
Separation	Magnetic drum	Shaking screen	Air separation	Flotation	Manual separation
Storage	Bunker	Containers	Dump	On trucks	On trains

Combination 1

Combination 3

Combination 2

Morphological Tableau: Fairytales

Parameter	Options					
Main actor	Little girl	Turkish boy	Tennis ball boy	A dwarf	Handicaped child	.....
Friends	Neighbourhood child	Dachshund	Grandpa and grandma	Pumuckl	The little people	.....
The evil	Witch	Magpie	Auntie Margot	Big dog	Caretaker	.....
Embodiment of good	Fairy	Grandma	Pigeon	Gardener	Lady from the castle	.....
Place of the action	Big city	On the beach	Family excursion	Ship	Kinder-garden	.....
Mysterious event	Cake/Coke is growing again	Switch into another world	Gliding over a moonlight ray	Serialized dreams	Reading mind	.....
Danger	Deep fall	Arrested	Noses are growing all over the body	Evil giant cat	Shrill noises	.....
Happy-end	A wish comes true	Parents come home	Big party	The cat is back again	Balloon ride	.....

Fairytale A

Fairytale B

Application of the Morphological Tableau

Application

- In general: Whenever a task, process or function can clearly be divided into independent parts, subfunctions, elements
- Complex problems
- Especially suited for:

* machines
* devices
* organizational tasks (organizing a conference)
* processes (with phases of different functions)

Situation in problem solving: After intensive open idea generation in order to structure the material and to separate between essential and less conceptual ideas (especially in workshops)

Weaknesses

- The solution stays within the established framework.
- Breakthrough-ideas can not be expected!
- Difficulty to maintain an overview over attractive solutions.
- Abstractive thinking required.

What Creativity Techniques achieve

- Establishing a clear focus
- Planned, organized process vs. spontaneous intuition
- Uses normal, competent staff vs. only highly creative
- Ensure discipline for cooperative group work
- Provide predictable results within a given time
- Does these things by
  - stimulating the creative process
  - compressing it in the time