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How to find new and fresh ideas

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Facts

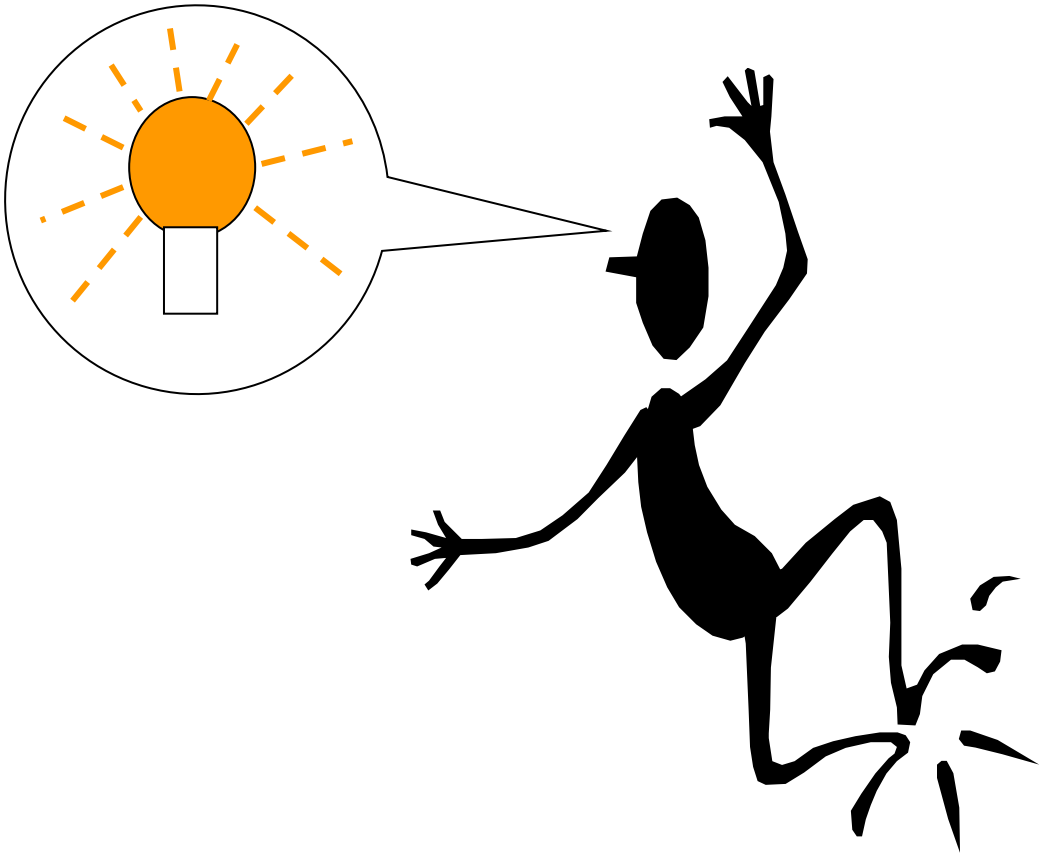
- Teaching of engineers develops mainly student's logical thinking. We give to students problems, which have one right solution like in mathematics 1 + 1 = 2.
- In real word engineers have to solve problems with many solutions. Engineers wish to find the best one.
- Engineers have to be innovative to win out in business word.

Contents

- Nature of creativity.
- Main rules for idea generation.
- AIR-OPERA method for idea generation.

Birth of Ideas

- Ideas are often born suddenly, they just pop up in the mind.



Birth of ideas (2)

- Work of years may hamper the creation of ideas.
  - We should find a way to reach a beginner´s mental level.
- Ideas can be born when old knowledge is considered from a new viewpoint (as Dr Edward Jenner did. He started to examine why milkmaids did not catch smallpox as other researchers attempted to find out why people caught the disease).
- Logical thinking is essentially ineffective in discovering new ideas. (Example Marconi and radio communication across the Atlantic).

Chance

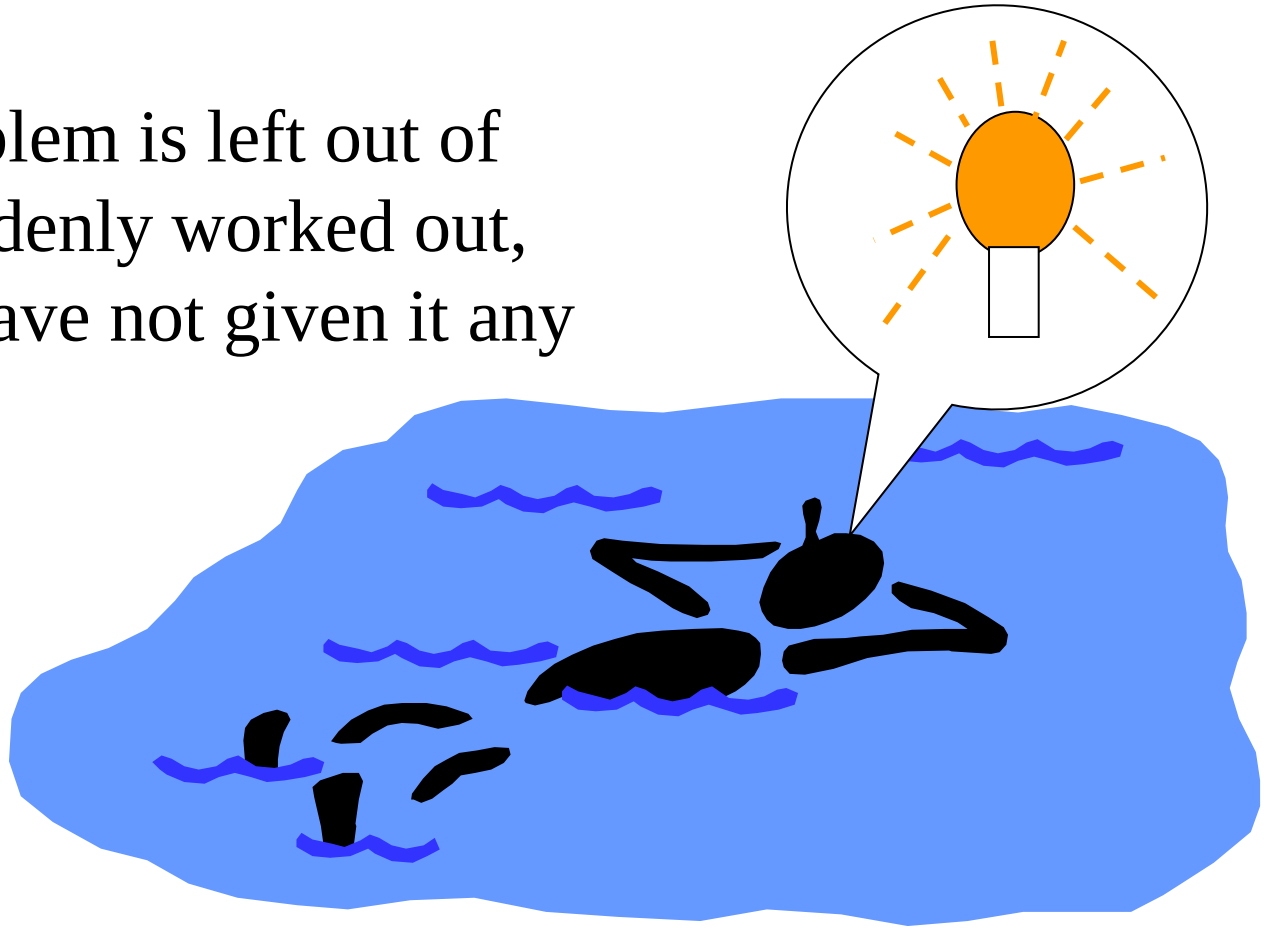
Chance is the beginning of very many ideas.

Examples:

- *Hertz* discovered radio waves when he began to wonder about a small spark in a device not connected to any of the test devices he was using across the room.
- *Röntgen* discovered X-rays when he forgot to remove a fluorescent plate from a table where he was making tests with cathode-ray tubes.

Forget Your Problem

- When the problem is left out of mind, it is suddenly worked out, although we have not given it any thought.



Dreams and Problem Solving

- Many times as we wake up, new ideas pop up in our mind. The solutions have grown up during our dreams.

Put a computer to work

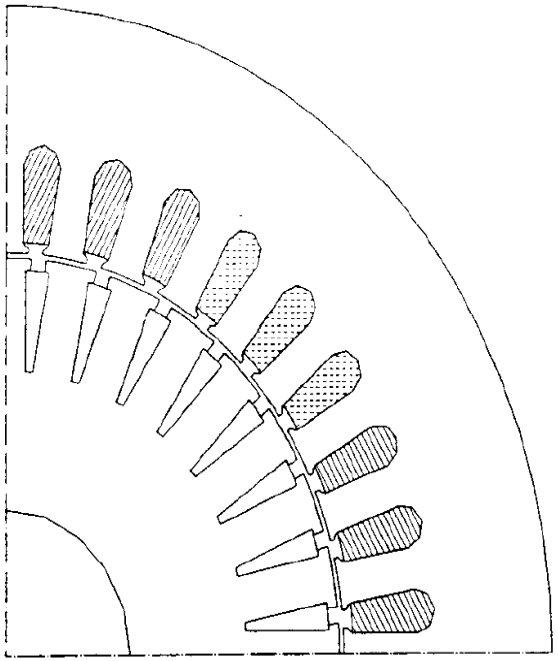
- May a computer be creative, if it can do only what it was programmed to do?

Example

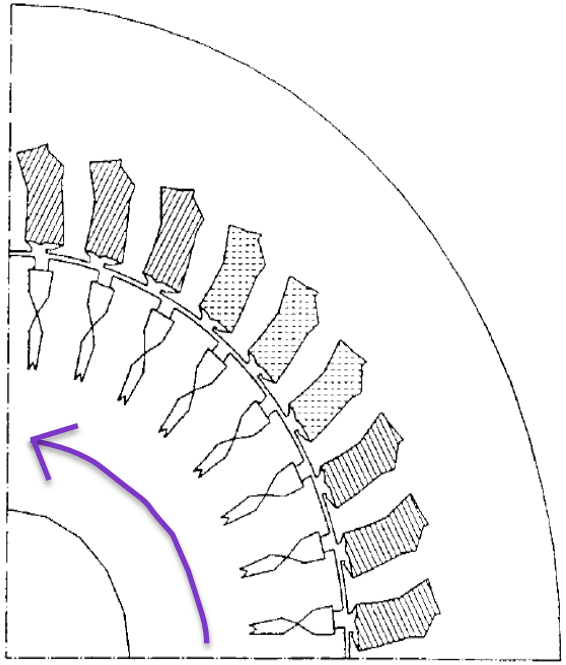
- The task is to find the structure for a 15 kW induction motor having a high locked rotor torque. The locked rotor current is limited below 260 A and the breakdown must be 1,6 times higher than the rated torque. The motor has 4 poles, 36 stator slots and 32 rotor slots. The outer stator diameter, shaft diameter and the length of the stator and rotor stacks are constant.
- Genetic algorithms and finite element method are used to solve the task.

Result

- The computer made an invention (?): double-cage rotor and slanting stator slots.
- Could we say that the computer was creative?



Initial Motor



Computer created motor

What is creativity?

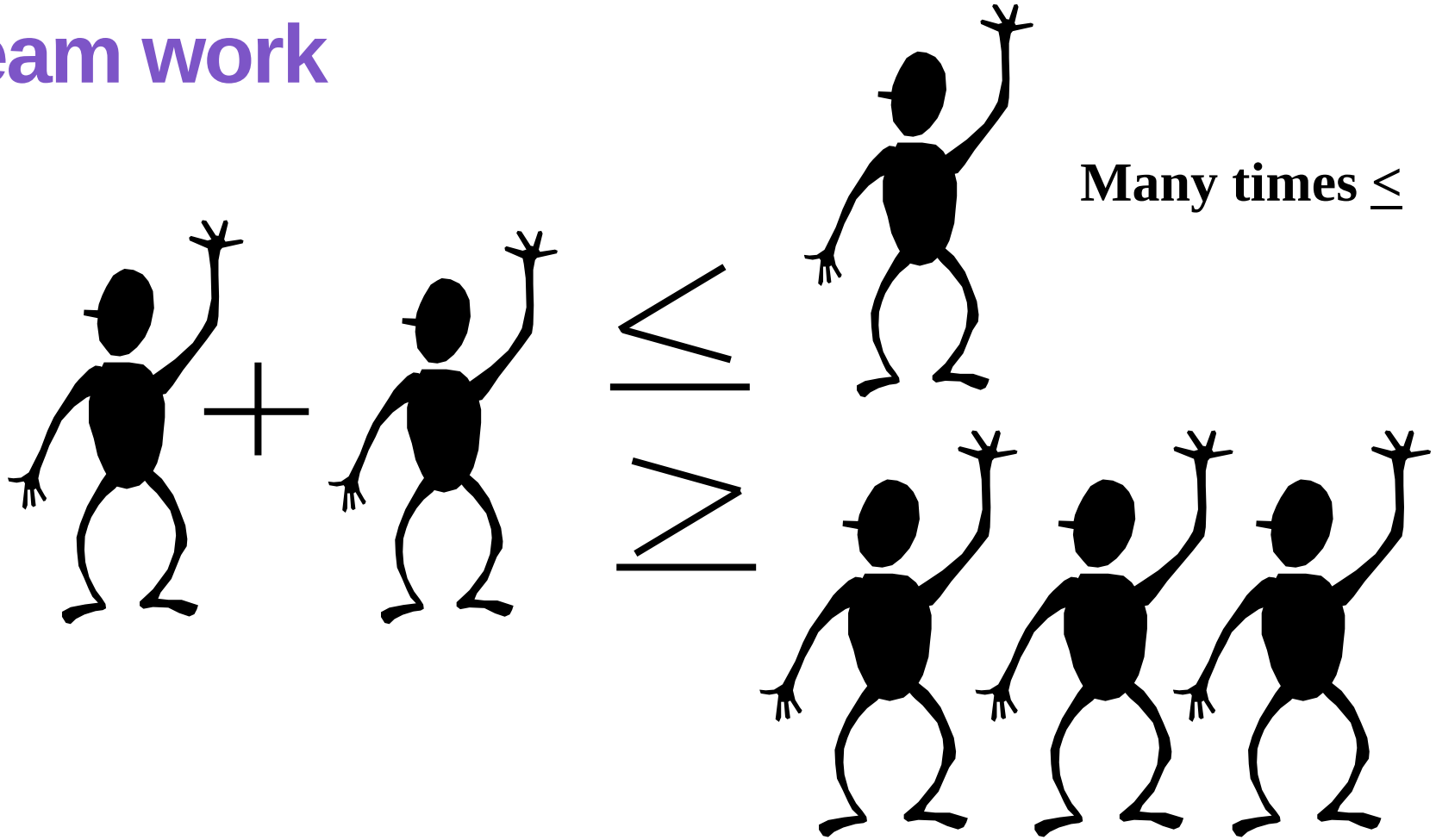
- One definition is: A solution is creative, if it is novel and useful.
- According to this definition, the computer was creative if we did not know the result beforehand.
- Many research groups work nowadays on the subject computers and creativity e.g. in the field of *machine learning*, *artificial intelligence* etc.
- The Association for Computational Creativity organizes annually the International Conference on Computational Creativity (ICCC).

How to improve our ability to find new and fresh ideas

Main Rules of Idea Generation

- Do not be satisfied with the first practical idea.
- Make a difference between the search for and the evaluation of ideas.
- Try to find unusual solutions, especially when the problem is difficult.

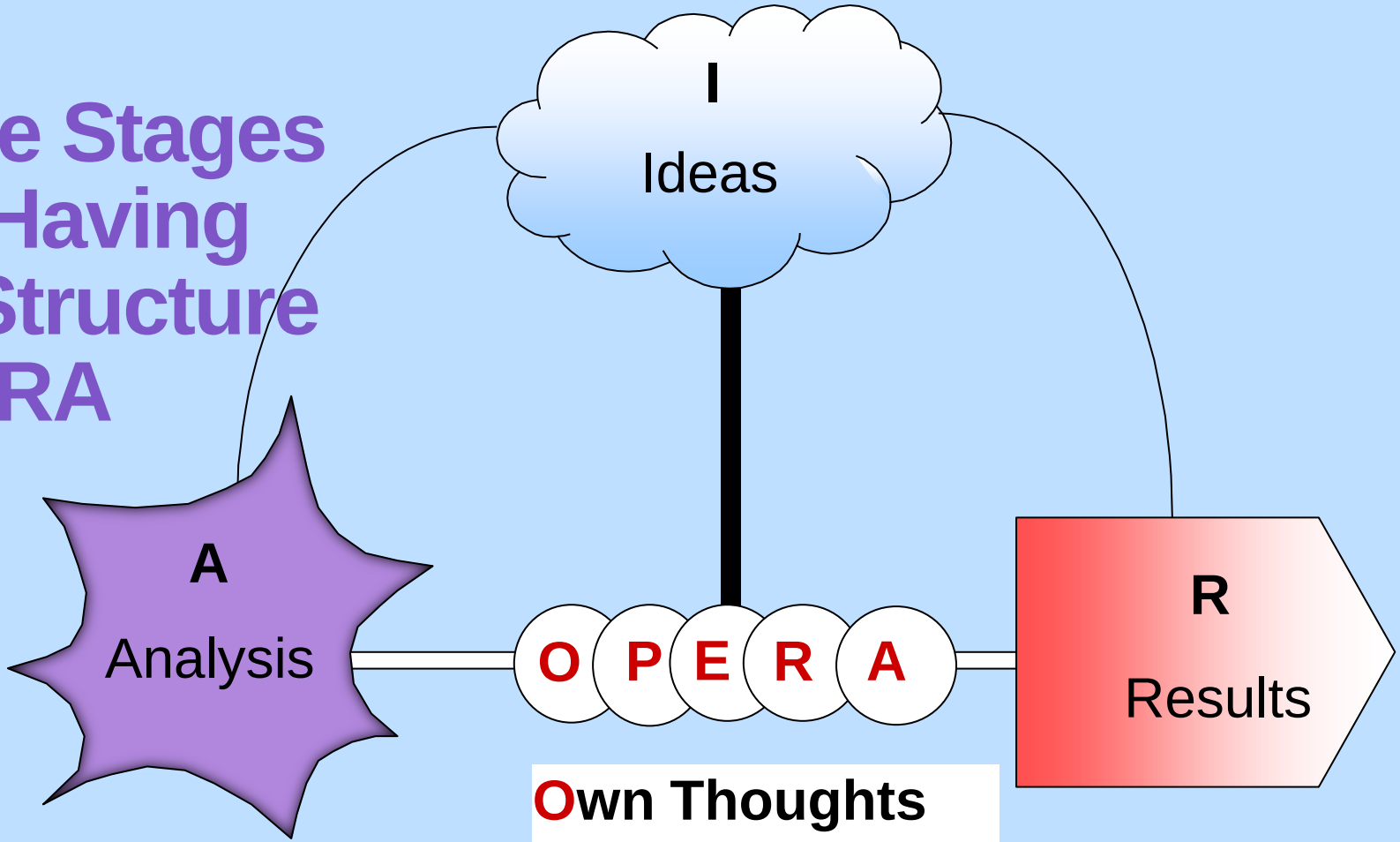
Team work



AIR-OPERA (Two & Two Method)

- AIR-OPERA, helps the participants to co-operate in a team and see the positive sides of other people's ideas.
- It changes the participants' points of view from their personal ones to that of the team.

Three Stages AIR Having the Structure OPERA



Own Thoughts
Pair's Thoughts
Explanations
Rating
Alignment

The First stage: Analysis of the Task

- The team is asked to find the most important problems or goals that it can think of.

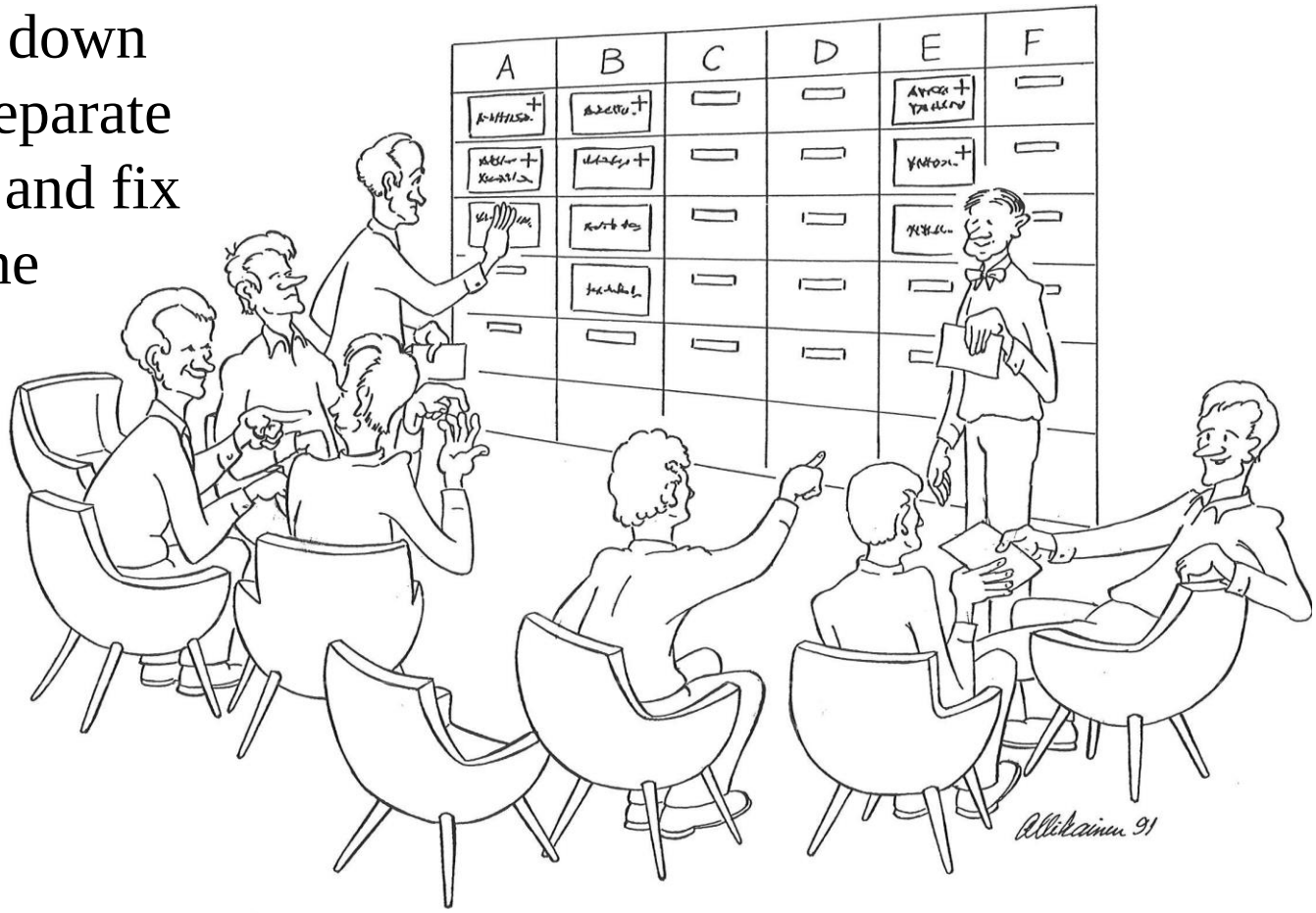
1. *Own thoughts:*

- Everyone works alone and write down his or her Own thoughts.

Analysis of the Task

2. *Pairs:*

- The pairs write down their ideas on separate sheets of paper and fix the papers on the matrix board.



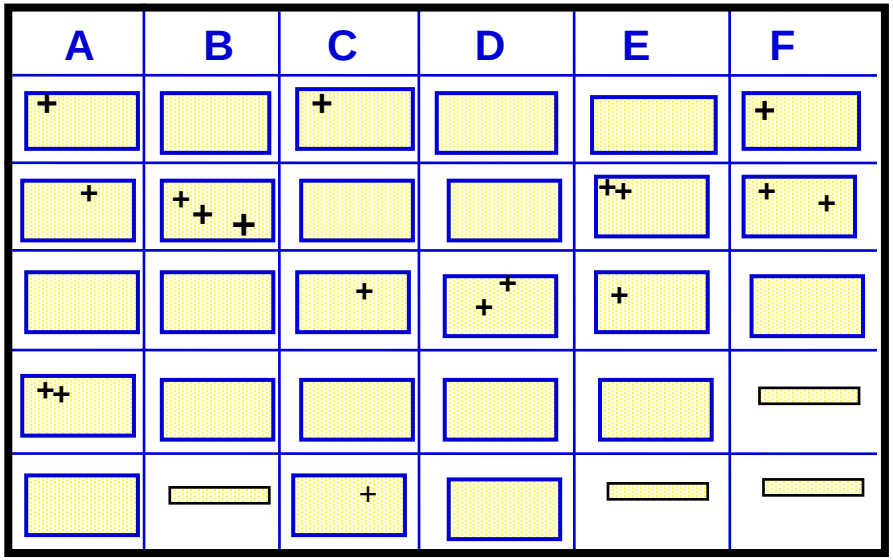
Analysis of the Task

3. *Explanation:*

- Every pair is given a couple of minutes to present their thoughts.
- No criticism or any kind of comments is allowed.

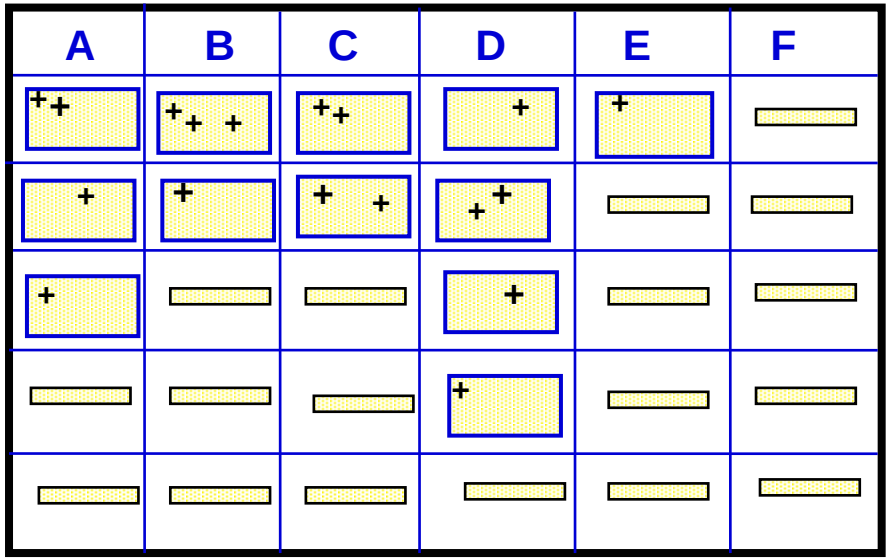
Analysis of the Task

4. Rating



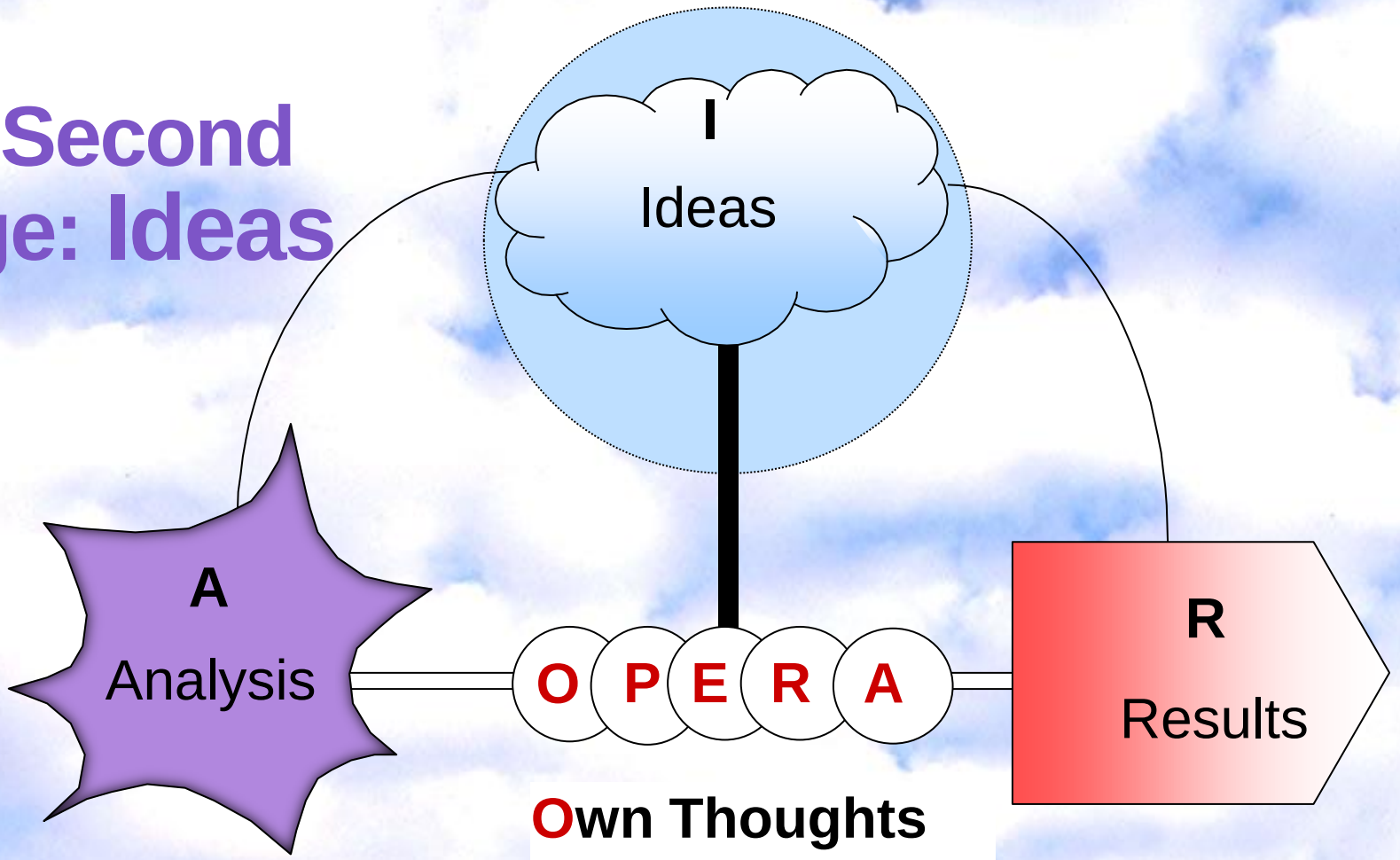
Each pair puts plus signs on their favorite ideas, not on their own column.

5. Alignment



Similar ideas are moved to a column.

The Second Stage: Ideas



Own Thoughts
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Ideas

The starting point can be either all the problems or goals that came up in the analysis, or it can be limited to one or two of the items.

1. Own thoughts:

- Everyone works alone and write down his or her Own thoughts.

2. Pairs thoughts:

- Every pair puts their best suggestions and ideas on the matrix board.

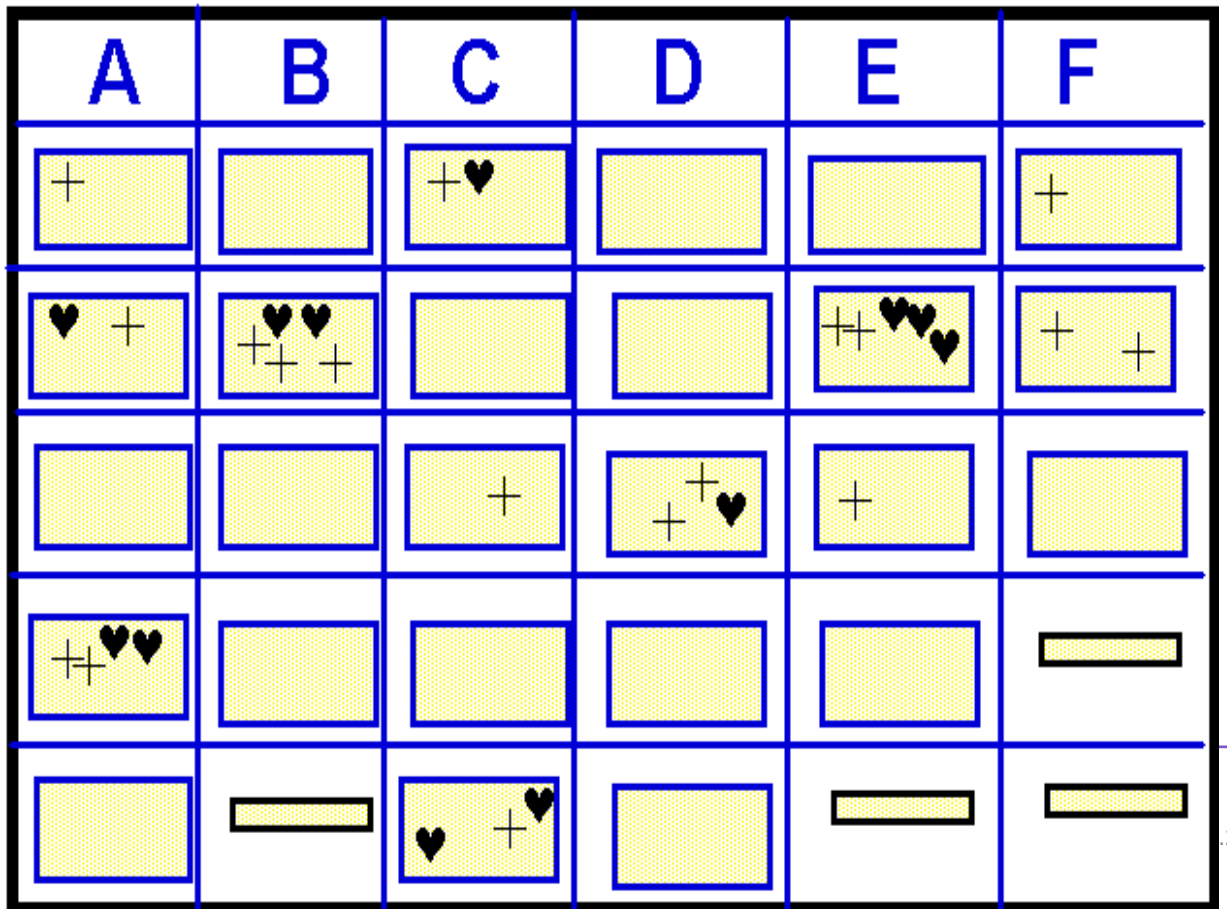
3. Explanation:

- Every pair presents their ideas.

Ideas

4. *Rating:*

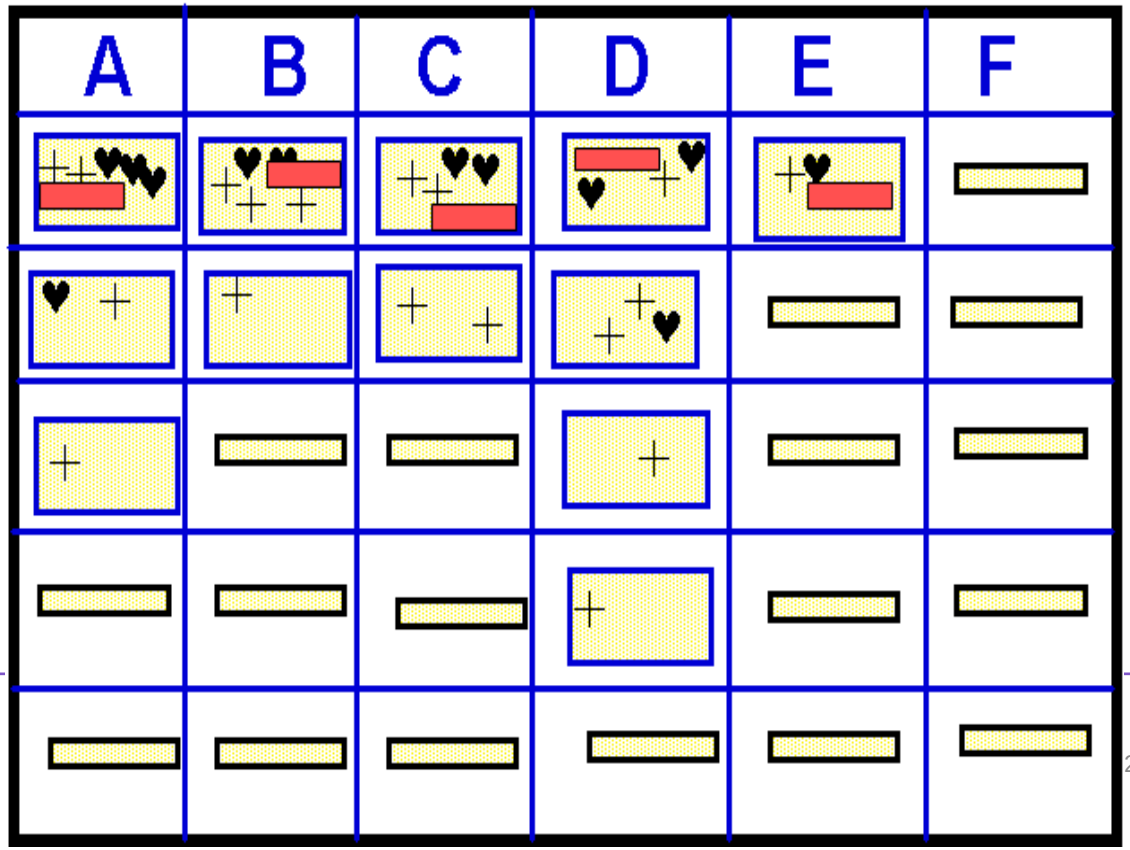
- Each pair puts five pluses on their favourite ideas.
- The pairs argue their points.
- Then the pairs mark the two top ideas with hearts.



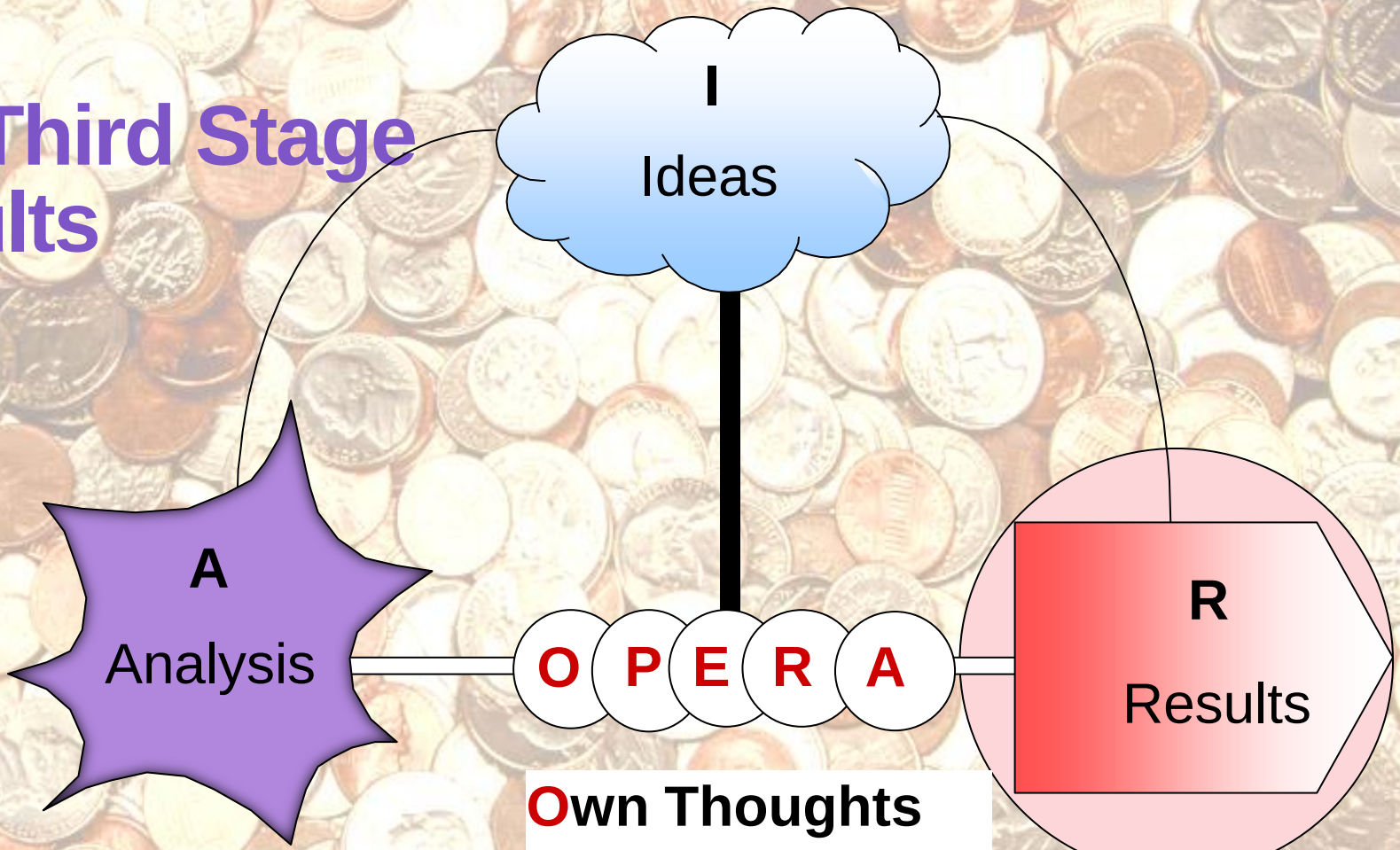
Ideas

5. *Alignment:*

- The proposals with the most pluses are placed on the top and similar ones underneath them.
- It is good to clarify the grouping by giving names to every group.



The Third Stage Results



Own Thoughts
Pair's Thoughts
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Results

1. Own thoughts ***2. Pairs thoughts*** ***3. Explanation***
4. Rating ***5. Alignment***

Actions plan

ACTIVITY	PERSON IN CHARGE	SCHEDULE
1. Write memo	George	Feb. 27th
2. Present decision	Paul	Mar. 1st
3. XXXXX XX	John Doe	Month, Day
4. XXX XXXX	Jane Doe	Month, Day
5. ---		

Strengths of the AIR-OPERA Method

- Everybody is actively involved in the process.
- Pairs: It is much easier to talk to one other person your own thoughts than with a whole group of people.
- As the pair presents their suggestions, the ideas are "our ideas". You are not alone with your ideas.
- The first evaluation is done during working in pairs.
- The evaluation is done with a positive criticism. Giving marks to the ideas of the others, has proved to be successful.
- On the matrix board everybody can see all the ideas continuously.
- The AIR-OPERA method has proved to be successful in building strong commitment among the participants. It always gives results.

Weaknesses of the AIR-OPERA Method

- The whole process takes time, three to four hours.
- The method is not the most creative problem solving method.
- If we need very unusual solutions for a problem, a better method is e.g. Synetics.


Thank you!